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REHABILITATION AS SEEN IN THE ROYAL AUSTRALIAN AIR FORCE: SOME THERAPEUTIC AND OCCUPATIONAL ASPECTS.

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The shallowness of the pool from which Australia was forced to draw men for the armed forces made it evident that the health of the men must be guarded carefully and those who were sick or wounded returned to duty with the greatest expedience and with as full function as possible. This was particularly evident in the Royal Australian Air Force, essentially a highly skilled technical service, from which the incidence of sickness and disability, small as it was, drew a proportion which could ill be spared. The importance of any method adopted to meet this drain on resources grew in ratio to the steadily increasing demands on our reserves of manpower. The time taken from the man's "reporting sick" until he reported fit for full duty was longer than the Royal Australian Air Force could afford under its rapidly expanding operational programme, and towards the end of 1942 the Directorate of Medical Services established the first medical rehabilitation unit, known at that time as a convalescent depot.

This paper is presented in order to describe the methods used in the Royal Australian Air Force to rehabilitate men in the therapeutic and occupational sense. I was in command of such a unit for two years, and although many of the following data are drawn from experience in one unit, a general survey from methods adopted in all rehabilitation units in this country is presented.

Rehabilitation is a common word these days, often used with little understanding of its principles. It is freely used in medical, surgical and orthopædic circles, as well as in legal and social spheres, and it is heard with remarkable regularity in any discussion of current affairs. Therefore it is necessary to define the word rehabilitation in relation to the medical services of the Royal Australian Air Force:[1]

> Rehabilitation is that method by which function, both physiological and psychological, is restored following illness or injury. It thus connotes the restoration of free movement to stiffened limbs, vigour to tired minds, of courage and confidence to quailing spirits; in short, the physical, mental and ethical toning up of the whole individual being. Obviously necessary physically, for most persons resuming work, even after a week spent in bed, it is less obviously—but perhaps more urgently—necessary psychologically.

THE NEED FOR SUPERVISED CONVALESCENCE.

Until October, 1942, the sick and injured of the Royal Australian Air Force either spent their convalescence at home on prescribed sick leave judged to be commensurate with the disability, or in rest or convalescent homes run by ancillary services, such as the Australian Red Cross Society, or else they were retained in base hospitals. The disadvantages of all these methods are apparent. Retention in hospitals was unsatisfactory because of the wasteful use of bed space, and because of the surrounding atmosphere of active illness, as seen in the busy medical, surgical and psychiatric wards, which is detrimental to a patient taking his first faltering steps along the road to full recovery.

Convalescent homes cater for men who do not require specialized medical and surgical supervision and treatment to complete their recovery. In simple, uncomplicated medical and surgical cases, for a limited number of operationally fatigued men, and for men with low-grade anxiety neuroses, in which the fatigue element has been predominant, such homes are ideal and much credit is due to them. Men who merely need to "get on their feet again" over a period of about a week or ten days are those who best qualify for disposal to these homes. Such patients would be those who have undergone appendicec-

tomy, tonsillectomy or simple herniotomy, or who have had uncomplicated upper respiratory tract infections, including some of the milder infectious diseases.

Home environment, however desirable to the patient himself, is seldom the ideal place for his convalescence. This is particularly true of the young airman who has just made, or is making, a reasonable adjustment to separation from home environment and familial care. Illness during early training and subsequent return home for convalescence have been the cause of many troublesome and poor adaptations to service conditions, leading ultimately to disciplinary troubles, psychoneurotic disturbances and lowered morale.

Too much care and indulgence may be given by fond parents and wives for the son or husband's welfare, and however commendable this is, the service suffers. Exception is found in the cases of those men, long separated by active service from their families, in whose case family, personal and marital troubles provide emotional and psychological overtones to the original disability, or may even in themselves be the cause of breakdown. Such patients, after careful selection by the medical officer acting in collaboration with the psychiatrist and medical social worker, are better sent home for a period—provided, however, a check on the patient's progress is made at reasonably short intervals and he is not allowed to become "home bound".

The bulk of the patients, however, qualify in the post-hospital stage for admission to a medical rehabilitation unit. An early policy directive laid down that patients were to be admitted for treatment in the following order of preference:

1. Orthopædic disorders.

2. Long-term medical disorders (of three or more weeks' duration, for example, nephritis, unresolved pneumonia, malaria and infectious fevers).

3. Long-term surgical disorders (including ear, nose and throat conditions).

4. Psychiatric disorders (principally the anxiety syndromes).

5. Other conditions (dermatological, ophthalmic and certain skin-graft cases). Included in this group are men for observation pending a decision on return to the service in the same mustering or for remuster on medical grounds to another trade or branch.

6. Disorders requiring "reconditioning" of the patient and further treatment before he is discharged from the service on medical grounds. Time spent in "reconditioning" a man is also used to fit him for his subsequent return to civil life, mentally and educationally as well as physically.

Emphasis is laid at this stage on the fact that the prime function of a medical rehabilitation unit is to restore sick and injured airmen to full duty within the service in the shortest possible time. In this respect the units are virtually human repair and salvage units, where the material is not aircraft, but human life. However, a subsidiary but vital function which has evolved in natural sequence from the essential function of rehabilitation for active front-line service, is rehabilitation to civil life, as useful and happy members of the community, of those who have been discharged from the service as permanently medically unfit.

The position in the Royal Air Force during the "Battle for Britain" in 1940, and the figures already obtained in the Royal Australian Air Force, have proved beyond doubt that the medical rehabilitation unit is a vital part of the war machine. Figures relating to the Royal Air Force published recently from a large series of sick and wounded personnel who have passed through these units indicate that 85% of air crew resumed full flying duties and 97% of the ground staff returned to work. Figures for the Royal Australian Air Force, although on a much smaller scale, show a similar admirable position.

It is essential to emphasize that rehabilitation to full fitness in the Royal Australian Air Force presents different problems from those found in the Army. Most airmen carry out highly technical work, and while it is essential for them to be physically toughened and to have reserves of endurance, and indeed to be saturated with "the offensive spirit", the conditions of service and work within the Royal Australian Air Force do not generally demand such high standards of physical fitness or stamina as are required of an infantryman. However, it is well to remember that mental tone and endurance and alertness of mind are closely connected with physical fitness. When the mind, as it were, loses its tone and does not put forth the effort needed so consistently in modern warfare, the body follows. It is this general fitness and resilience with which medical rehabilitation units are specially concerned.

Entry into a Medical Rehabilitation Unit.

At what stage is the airman sent to the medical rehabilitation unit? The answer is that he leaves base hospital immediately he is fit to travel, and when active hospital treatment has been completed. At the earliest possible stage he should be taken from the atmosphere of sickness into the sunny, cheerful, optimistic surroundings of the medical rehabilitation unit, where he can see, hear and smell the sea or the hills around him. When he does this he has taken the first step along the road to complete recovery. He sees bright flowers and green trees, and plants growing taller and stronger each day, and it is not without the bounds of possibility that he gains from them something of the spirit of growing well himself. Perhaps this is in the realm of fancy; but I do not think so.

It is not possible to stipulate, for example, that an appendicectomy patient may leave the base hospital for the medical rehabilitation unit on the sixth day, although this is commonly the case. Local conditions in any particular patient may make it impossible, but so long as the medical officer in charge of the patient at the hospital is aware at all times of the significance of early restoration of full function, then it can be assumed that men will be discharged to the medical rehabilitation unit at an optimum stage.

General Description of Medical Rehabilitation Units.

Medical rehabilitation units of the Royal Australian Air Force have been selected with a view to the location of feeder units, such as base hospitals and flying training units, lines of communications from these, distance from capital cities and big towns, public and service transport utilities, and available sites. The smaller units are of 50 beds and the larger of 100 and 250 beds. Each unit has problems peculiar to itself, and has been developed and adapted according to them. However, the same broad general policy regarding treatment, organization, administration, equipment, establishment, staff and general facilities has been laid down by the Royal Australian Air Force Medical Directorate. The following applies with only minor variations to all Royal Australian Air Force medical rehabilitation units. Four units are in hilly districts and the others by the sea, at distances from capital cities varying from 10 to 100 miles. Three are in forward areas, in pleasantly situated, non-malarious areas, with a spring or river near by for swimming. The value of a pleasant site and an equable climate cannot be over-emphasized. The largest medical rehabilitation unit within the service is situated along the curving shore of one of the most famous and lovely bays on Australia's eastern coastline. A three-mile long, firm, white-sanded beach, flat and broad, is fringed with pleasant shrubs. There are a tidal swimming pool, with a safe, shallow end for those timid by nature or by injuries, a nine-hole golf course, eight tennis courts, a grassed playing field large enough for cricket, baseball, football, "rugger", volley ball and basket ball, and a bowling green. In this glorious environment it would be impossible not to recover at least a considerable portion of mental optimism or to reestablish a happy service outlook following mental or physical injury and sickness. Here in this sunny portion of Australia are peace and quiet, colour, warmth and an equable climate. Here is the best that land, sea and air have to offer patients, who may rest, work or play just as hard or as gently as is decided by the medical officer in charge.

In this ideal setting has been developed a balanced programme of rest, work and play. Treatment is always directed towards the active, functional side. Hobby, recreation and study periods are harmoniously blended,

and even the most resistant patients, and those who are refractory either consciously or subconsciously, finally return to fitness, often despite themselves. The units situated by the sea have experienced less difficulty in providing recreational and remedial facilities than those in hilly districts, for they have the beach for games and sports, and the sea for sun-baking, swimming, fishing and sailing. The climate is usually more equable, and nothing is better than a firm sandy beach for remedial games.

Accommodation.

Sleeping quarters for patients vary with the nature of the buildings occupied. Barracks are preferred, and these are made cheery and attractive, each man being allowed the maximum of privacy and his own bedside locker and wardrobe. Small rooms holding from one to five men are frequently found in non-standard buildings. Comfortable recreation rooms and dining rooms are essential, and, like those used for rest, study and education purposes, should be well ventilated, light and cheerful.

Staff: The Medical Rehabilitation Team.

Every member of the staff contributes something to the "rehabilitation team" and the work it does; but the main responsibility rests with the commanding officer (medical), the medical officers, the occupational therapist, the physical therapist, the education officer, craft workers, and the nursing sisters (specially selected for their aptitude in rehabilitation work). The adjutant, although he occupies a position which is primarily administrative, is an important member of the team, for he has to handle endless minor matters which can affect a patient's outlook, either favourably or on the other hand so unfavourably that he becomes resistant to discipline and treatment suffers. In this respect also the disciplinary warrant officer holds an important post and should always be carefully chosen. His is no easy task, for the invalid patient is far more difficult to manage than either the really sick or the fully well.

The welding of these staff members into a harmonious team is the task of the captain of the team—the medical officer in command. Unless there is a harmonious team spirit, aimed at giving the patient the very best, then much of the true value of rehabilitation is lost. A team working towards a common goal can do so much more than isolated members, working indifferently without cohesion. For this reason weekly staff meetings are held to discuss working plans and the problems of individual cases. These meetings are in addition to the weekly reviews by the medical officer. The administrative burden is carried mainly by the medical adjutant and the medical administrative officer, usually a Women's Auxiliary Australian Air Force officer.

The Organized Daily Programme.

An organized daily programme is carried out at each unit. In dealing with the variety and number of patients admitted to rehabilitation units, a haphazard allocation of treatment will not be satisfactory. On admission to the unit patients are classified by the medical officer and wear a coloured button denoting the category in which they have been placed. For example, a white button indicates that the patient has arrived from base hospital, is to have very light duties and be watched closely, and that his activities are to be curtailed; a yellow button indicates that the patient is beginning to "get on his feet" and may start light toning-up exercises; a green button indicates moderate fitness and that the patient may begin harder exercises, moderate outside duties, and heavy craft work; a blue button means "almost fully fit—to begin toughening work and exercises and heavy crafts"; a red button means "fit full duty, awaiting disposal". In the larger units patients are further divided into "flights" and graded according to the type of disability as well as its severity. This enables classes to be organized for remedial and occupational therapy.

A daily routine card system is used, and personal details are recorded there. This does not, however, indicate to the patient medical details of his disability, which it is better that he shall not know. Personal and service details are noted on the card, with a record of weight and diet and a brief outline of treatment. Appointment times for work in different sections of the unit are noted. These appointments, when filled, are initialled by the officer or non-commissioned officer in charge of the section, and thus a check is made on the patient's activities, without at the same time his being given the feeling that he is being hounded to work. Continuous supervision engenders a feeling of resentment among the legitimately employed, while parades serve only to interrupt the continuity of treatment and especially the out-of-door activities.

Soon after he has settled down at the unit (usually on the second or third day) the patient is "boarded". The board members are the officer members of the staff who will be directly concerned with his treatment and his welfare. The patient is called in, and as the procedure is not in the nature of a parade, he sits down comfortably and is made to feel at ease during the interview, which lasts from five to ten minutes. There is an opportunity for mutual recognition by the patient and members of the rehabilitation team. The general scheme of the unit and its aims and function are outlined by the commanding officer, who always presides. The commanding officer also estimates and explains the limits of the patient's activities and makes suggestions regarding the type of treatment and occupational therapy to be allotted, and the colour of the first category button to be worn. Brief inquiry as to the patient's own choice of occupational therapy gives an opportunity to plan work and treatment in accordance with his medical category. The time and date that he will first report for this treatment are marked on his card, together with times of appointments with other members of the staff and section commanders. By this means his activities for the next few days are planned ahead. At no time during the interview is the patient's disability discussed, except where there are obvious points of common interest, of which the patient already knows. Should there be any special circumstances connected with the case, the staff is informed by the commanding officer after the man has retired. By means of this "boarding" the patient receives a psychological lift, for he has found that the executive members of the staff are interested in him as a person of some importance, and in a way that he has probably never before experienced in the service. He feels that they are interested in his particular problem (which is always more important than anybody else's) and that he is not regarded as merely "just another patient". The "boarding" is of value from the staff's point of view, as it familiarizes them with the patient and his problems and the relevant facts of his case, and provides the occasion for discussion of ways and means to treat him best and help him most.

All patients are examined twice a week, and as their return to fitness is noted they are moved up the button category scale, which allows for an increase and a variation in activities; these facts are recorded on the card, which is eventually filed for reference. The criticism may be made that the system savours too much of school procedure and regimentation. Actually this is not so, for each man is treated as an individual and the responsibility for reporting for the prescribed treatment rests with the man himself. The system removes the need for constant supervision, engenders a spirit of cooperation and removes all feeling of compulsion. The time of every man is accounted for during the whole of his stay on the unit; there is no overlapping of periods, and a balance between work and recreation is maintained and a progressive programme planned and carried out with a minimum of supervision and disciplinary enforcement.

Therapeutic and Occupational Rehabilitation.

It is proposed to divide the remainder of this paper into two sections: (i) therapeutic rehabilitation and (ii) occupational rehabilitation (including industrial rehabilitation). Broadly, the first section will deal with all aspects devoted to the return of the patient to service with the Royal Australian Air Force and in the same mustering as before his incapacity. The second section will include a discussion of those facilities available at a medical rehabilitation unit to help an airman in one of two ways—either to return to the Royal Australian Air Force as a fit and active member, but in a mustering different from that held on his

enlistment (because of a medical or surgical disability), or to return to civil life as a useful member of society following discharge from the service on medical grounds.

It is not possible to give total absolute figures; but approximately 88% of all men admitted to medical rehabilitation units come under the first section—that is, they return to service in the same mustering. Of the remaining 12%, approximately 8% return to service after remuster action has been taken following a period of complete or partial training in the medical rehabilitation unit. The final 4% are discharged from the service as medically unfit and are cleared to civil life through a personnel depot, but not before the facilities which have been developed at the medical rehabilitation unit together with other outside help have been brought to bear on each individual problem. The outside aids include the social service departments of the Australian Red Cross Society, the Returned Sailors, Soldiers and Airmen's Imperial League of Australia, the Fighting Forces' Family Welfare Bureau, and the regional advisory committees of the Department of Post-War Reconstruction and the Commonwealth Reconstruction Training Scheme. But in whatever category a man comes, he is made either a more useful citizen or a better equipped airman as a result of the time which he has spent in a rehabilitation unit.

Therapeutic Rehabilitation.

Treatment of a patient in a medical rehabilitation unit is both active and passive, and no sharp division can be made between the two types. They are indeed closely connected and together form the rungs of the ladder by which the patient climbs back to the world of full and vigorous health. Preston[2] boldly expresses the conviction that "absolutely anything which happens to the patient is treatment, good or bad".

It is thought best to discuss both active and passive treatment under the two headings (*a*) remedial and (*b*) diversional.

Remedial Treatment.

Physical Therapy.—A well-equipped gymnasium is combined with a physical therapy section. There are massage cubicles, treatment benches, electrical apparatus, a plaster room and a small office for the physical therapist. The physical therapy section may be called the "passive" section, while the adjoining gymnasium is the "active" section. However, both are an integral part of the same unit and cannot be otherwise. Corrective exercises are demonstrated in the gymnasium by the masseuse and the physical training instructor, and are carried out by the patients, who are grouped in classes according to disabilities. The medical officer visits the section regularly and supervises the work. In the summer months games are played out of doors.

Considerable ingenuity has been displayed by physical therapists in designing new remedial apparatus. Plans are submitted to the medical officer and decisions are made with a view to functional and interest-stimulating value. These simple but effective pieces of apparatus are frequently made in the unit workshops by patients. Such enterprise is given the greatest encouragement because of its real value to the patient, both psychologically and remedially. Few things are more gratifying to the medical officer than to hear a keen patient planning with the aid of the staff something which will aid his own recovery, and then later to see him making it in the unit workshop. The final triumph comes when successful results are obtained, for then the patient has a sense of real and personal accomplishment which can be gained in no other way. Such self-help accelerates recovery in a remarkable manner, and it is gratifying to see how the team spirit is fostered and spreads through the unit.

Standard physical therapy equipment for a hundred-bed unit consists of three wall bars, a sand pit (for toe-kneading exercises), a wall mirror about six feet square (for muscle reeducation exercises), two arm-supinating machines, a battery of four quadriceps drill pulleys with weights and sandbags, a ship's wheel with a resistance clutch (for spine and back exercises), a set of high, low and medium parallel bars, a set of twelve-inch stairs with guide hand rails, a punch bag and a punch ball, three climbing ropes, a set of Roman rings and a trapeze, two spine plinths, two sets of graded stools (six to eighteen inches), a static cycle with variable resistance wheel and an "ergometer" or revolution counter (for use in competitive classes), a rowing machine (either spring or hydraulic), a horizontal bar, a set of twelve medicine balls, sets of Indian clubs of varying weights, dumb-bells (spring grip), rubber sponge or horsehair gymnasium mats about six feet square, and a score of skipping ropes.

Electrotherapy has a definite place in the physical therapy section of a medical rehabilitation unit. The following are provided: a diagnostic or "switch" table, with a range of faradic, galvanic and sinusoidal currents, an inductotherm (short wave) machine, three infra-red standard lamps, and an ultra-violet radiation lamp. Units of 250 beds are provided with a small portable X-ray plant for checking the progress of fractures.

The physical therapy and gymnasium units are large, airy and well-lighted rooms made attractive by displays of coloured pictures and posters and illustrated slogans of games and exercises. Weekly or biweekly reviews of patients are made in the gymnasium, where actual function can be observed. The medical officer, physical therapist, occupational therapist and physical training instructor attend, and if there are matters relating to dressings or plaster care or similar problems to be discussed, the senior nursing sister attends also. A nursing sister is usually in charge of the unit diet programme.

Remedial Games and Exercises.—Specially trained non-commissioned officers are in charge of games and remedial exercises. These non-commissioned officers are important members of the staff and have been carefully selected for their specialized work. They encourage the not-so-keen and the timid, and foster the team spirit among patients. They select teams for games, bearing in mind the physical demand that each game will make on the patient and the benefit to his health. They organize tournaments and competitions, restrain the over-vigorous and enthusiastic, help the "lame dog" by example and encouragement, and report full details of progress to the medical officer.

The physical training instructor devises new, interesting and beneficial games, modifies the old ones, and generally stimulates the men to take a healthy interest in a vigorous, active way of life. He arranges cycle tours for suitable patients, cross-country hikes, swimming contests, cricket and football matches—in fact, any competitive games that in any way benefit patients. The close liaison between the medical officer and the physical training instructor is emphasized. These instructors have been trained at special schools, where they learned the underlying principles of remedial games and exercises. They are really important members of the rehabilitation team, and are usually selected from experienced non-commissioned-officers who have already displayed merit in handling men firmly but sympathetically. They must be able to appreciate the peculiar state of mind of the invalid and realize that the road to normality can be difficult and irksome. They have the hard task of being cheerful and optimistic at all times; but they must do this if they are to contribute their full share to the success of the unit.

Little is to be gained by enumerating in detail the games and sports and special exercises. The main ones are those known to every Australian: cricket, football, soccer, soft ball (a modified baseball), tennis, golf, bowls (an interesting and skilful game for those who are just "finding their feet" and an excellent game for all patients with knee, leg and back conditions), swimming, badminton, volley ball, squash racquets, deck tennis, medicine ball games, circlos and basket ball.

Occupational Therapy.—The larger units have on the staff a graduate of the Australian School of Occupational Therapy. Such a three-year course includes training in physiology, psychology and anatomy, and a wide knowledge of the arts and crafts. Allotted to each occupational therapist is a craft worker, skilled in the essentially practical side of therapy, but without the scientific background and training. Such officers are members of the Women's Auxiliary Australian Air Force. In smaller units the task of the occupational therapist has been handled collectively

by the medical officer, the education officer, the masseuse and the craft worker. Such an arrangement is not to be compared in efficiency with that in which an occupational therapist is a member of the rehabilitation team. The occupational therapist is the dispenser of the "treatment through function" prescription which has been written by the medical officer. Occupational therapy cards are kept, filed and later analysed. They record the disability, the therapy prescribed, the response and progress made, and other relevant comments. Information from this section of the unit is added to a summary card, which is kept for statistical purposes. "Occupational therapy is a treatment available in both medicine and surgery whereby patients can receive the necessary stimuli to occupy themselves in every way that tends to recovery and rehabilitation as full members of the community or fighting force".[3] The benefits of occupational therapy as applied to bony injury are exemplified by J. B. Mennell as follows:[4]

> Let us consider the case of a Colles' fracture of the wrist, when the fingers are weak and stiff. The man who wishes to make the most rapid recovery will work in the garden with everything with which he can employ both hands. Even though at first he may be unable to grip the grass shears, the spade or the broom, the very effort to do so is of great value, and occupational therapy with an objective is more valuable than any other form of treatment. This is because submaximal effort is constantly repeated for hours at a time. Perfection of function is restored by exercise in function, and not by routine exercises alone, however well-planned and executed these may be. It must always be remembered that we apply to remedial work the elementary principles of ordinary training. After injury, prolonged illness or disease, the amount of exercise and training required to restore perfection of ordinary function may be no less; perhaps more, than that required by the healthy individual before entering for a race or tournament.

This same author epitomizes the value of occupational therapy when he states that "no massage, no passive nor assisted movement, no apparatus, be it electrical or mechanical, has ever yet originated, nor ever will originate, a single voluntary impulse; and it is from voluntary impulse alone that function can come".[4]

Within the rehabilitation units occupational therapy is never haphazard, never prescribed at random, and never given merely as a relief from tedium. It is scientifically applied to each individual case, and only after every consideration has been given to individual needs, with regard to the physiological, psychological and functional requirements related both to the patient and to the duties he must perform within the service.

The rehabilitation units have well-equipped workshops, which are large, light, airy and cheerful, with an atmosphere of industry and endeavour. Hand tools and machine tools, such as lathes, jig-saws and drills, are of the highest quality. Pride in workmanship is essential, and it is not overlooked that most of the patients are from technical musterings, and both by instinct and by training they do not allow shoddy work from shoddy tools. In fact "shoddy" is not tolerated, for the service cannot afford to permit any second-grade work, quite apart from the fact that it is fundamentally wrong. No patient is allowed to spoil material through carelessness or indifference. Within the main workshops are facilities for woodwork, joinery, woodturning and metal work; and although "tinkering" is sometimes permitted, planned work with a definite functional basis is all-important.

Occupational therapy is purposeful activity. It is appreciated that not every task allotted to a patient has a productive purposefulness; but this ideal is aimed at when work in the occupational therapy section is being planned. One part of a certain task may have remedial value while the rest is merely interesting or inseparable from the main job. For example, a patient with a stiff elbow is making some furniture. The actions of planing the wood, sawing and sandpapering, involving strong flexion and extension at the elbow joint, are the useful, remedial elements—that is, they provide "exercise in function"—while the remainder may be of little value from a specific remedial aspect, although of some value in coordinating the job as a whole and in giving the patient a sense of creation.

In orthopædic cases the functional value of occupational therapy is predominantly muscular and physiological (although mental outlook is important); while in the treatment of psychoneurosis, for example, the functional value is predominantly psychological. There is nothing better for the psychoneurotic than to be absorbed in the task before him, to the absolute exclusion of everything else, especially the subject of himself.

The list of activities in occupational therapy grows all the time as new crafts are developed and old ones are modified to meet the demands of new disabilities, each with its special problem. In addition to woodwork, including wood-carving and metal work, there are wood-turning on lathes, metal-turning, pottery with both power and foot-treadle potter's wheels, moulding in clay, gardening, farm work (skilled and semi-skilled) on the model farm and animal husbandry section which have been developed on these units, and a number of minor, unclassified duties associated with unit maintenance to which every patient contributes a small share. The animal husbandry section on most units is run as a small but efficient "model farm" and supplies dairy produce to the unit kitchens. Similar work is also done in the vegetable and flower garden sections. A popular section is that devoted to radio and wireless telegraphy. Equipped from service salvage material, these sections provide experimental, teaching and broadcasting opportunities. Rehabilitation to assist in their return to active service is given to members of air crew. Rather than their suffering a total cessation, or at least a non-productive gap, in their training, their time in a medical rehabilitation unit is used to develop radio telegraph standards even above those exhibited at the time of injury. Stiff wrists benefit from tapping Morse keys, and lungs fill with fresh air and bodies bask in sunshine when parties go out on signalling trips and send messages from hill to hill with Aldis lamps.

In some units the equipment and materials for the craft section of the occupational therapy division have been provided by the Australian Red Cross Society, together with trained demonstrators in handcraft work. This has applied particularly to the smaller units. At larger units the service has provided both the materials and the craft workers. Only light duty men attend the craft sections, except those sent by the occupational therapist for specific therapy. Basket-making, weaving, rug-making, macramé string work (requiring considerable manipulative skill), leather work, book-binding, lino-cutting, spinning and poster lettering are some of the main crafts available.

Psychotherapy.—Almost the only patients with nervous disorders who are treated by rehabilitation units are those with anxiety neuroses, occasional patients with toxic and confusional psyehoses, and patients with certain undetermined conditions of a mild nature who are admitted for observation. Much success has followed the treatment of such patients, which consists mainly of persuasion, diversion, occupation, discussion with and reassurance by the medical officer, vigorous outdoor activities, improved living conditions, and removal from the source of mental disturbance. This *régime* applies particularly to those subjects suffering from mental aberration following debility from privation in jungles and hostile territory, with an overriding acute anxiety neurosis from sustained personal danger. Self-confidence is regained by joining in games, contests, entertainments, debates, "quizzes" and the general social life of the unit.

> Cases of mild neurosis necessitate a policy based on most careful consideration. The practice of countering the neurotic tendency by cultivating its antithesis—the robust spirit of energy and confidence appropriate to healthy youth—involves a continuous strain on the commanding and other medical officers, who must inspire, develop and maintain that effort as essential to securing the best results from an aggregation of semi-convalescents. While the commanding officer sets the standard, the medical officers cooperate by seeing that they, or members of the staff, maintain contact with every patient, and show a personal interest in his welfare and progress. The physical training experts make their contribution by their enthusiasm, resource and patience. The efforts of the whole staff thus create an atmosphere which is the antithesis of that in which the neurotic revels, for every trainee is rapidly con-

vinced that his complete recovery is assured by special attention, and he senses the *joie de vivre* of physical fitness nearing its zenith among friends also preparing for devoted services in the great crusade. Neurotic tendencies should die out in such an atmosphere of vitality, confidence, comradeship and good cheer.[1]

Many men admitted to medical rehabilitation units have their home in the State in which the unit is situated. This is because of the policy of invaliding men, who will be unfit for long periods, through personnel depots in their home States. Unhappy personal conditions and disrupted domestic, marital and general social conditions are often the underlying cause of the anxiety neurosis, or can at least be blamed for the non-recovery of many who would normally recover within a reasonable time and return to duty unhampered by residual anxieties. While it is true that fighting men should think primarily of their service obligations, the fact remains that social problems can and do reduce even the best types to a low state of service efficiency. This fact can never be overlooked in a rehabilitation unit, which is in fact the very place where many such social problems can best be tackled and resolved. It is my experience that much outstanding work in this direction has been done by the medical social workers of the Australian Red Cross Society. These women are highly trained in all aspects of medical social work, especially in relation to the services, and have an excellent appreciation of the relationship of social, domestic and family affairs to the incidence of disease and disability and to recovery from them. Maximum cooperation is necessary between the medical officer in charge of the patient and the medical social worker, and the confidence of the patient must be gained by both at an early stage. Supervision of home conditions by visits and follow-up work by social workers have prevented many subsequent breakdowns after the patient's discharge from the unit.

Sick-Quarter Treatment.—Each medical rehabilitation unit is equipped with a few beds for intercurrent illness and for mild relapses of existing conditions, and with a surgical dressing room where minor injuries are attended to and continuation treatment is given.

Diversional Treatment.

It will be appreciated that all the activities mentioned so far as belonging to the field of occupational therapy provide at the same time recreation or diversion. By some diversion is said to be nothing more than relief from tedium. Nevertheless, the word recreation means what it says, and recreation is diversion. Thus all activities mentioned so far have a twofold purpose. Entertainment is diversion, and each rehabilitation unit has developed amusing, interesting and informative entertainments. Such entertainments are principally the concern of the unit welfare committee and the unit education officer, who is also responsible for all matters relating to service education and advanced study courses for various musterings. Patients are encouraged to maintain this study while they are in the unit, either continuing their interrupted study training or advancing training already received. The unit education officer gives advice and assistance in connexion with post-war rehabilitation schemes, and in the case of the patient to be discharged as medically unfit, helps him plan for the future. The education officer is in charge of visual education and keeps all members of the unit posted with the latest news of war zones and the work of the flying services in particular. A special room, called the "war room", contains pictures, wall maps, relief maps, aircraft models, posters and war pictorial histories. This officer is also responsible for the wall newspaper, on which are recorded items of general as well as war-time interest. Official war news is related by tape pointers to geographical sectors and war areas, and patients are invited to assist in this work. Musical appreciation evenings, concerts and educational lectures are given. This officer is responsible for supervision of aptitude testing procedures for remuster action on medical grounds.

Occupational and Industrial Rehabilitation.

The second part of this paper will deal with the problem of airmen who are rehabilitated to the service, but only after some retraining has been carried out at a medical rehabilitation unit. Such patients include those who have been remustered on medical grounds. The following example will illustrate the principle involved.

Leading Aircraftman "A", an armourer, received bad corneal burns to both eyes from cordite of an exploding shell, which he was handling contrary to orders. For several months he was under treatment in a base hospital. He made a reasonable recovery in the circumstances, but suffered from diminished visual acuity (it fell below the standard required of an armourer), and this fact, combined with the nervous trauma which he suffered and the lack of confidence which he developed, made him manifestly unfit to remain in the Royal Australian Air Force as an armourer. The ophthalmologist under whose care he came asked that he be kept under review for a further two months as an inmate of a rehabilitation unit. The consultant stated, however, that the man would have to be discharged as medically unfit as an armourer. As was expected, his visual acuity improved a little while he was at the medical rehabilitation unit, and with careful psychological handling, his confidence in himself returned also. At the "board" held on his entry to the medical rehabilitation unit it was found that he was twenty-three years old, single, and without any special kind of training to fit him for return to civil life. He stated, however, that he was "a bit keen on carpentry, and had tinkered about with it". He was accordingly set to work in the unit workshop, where it soon became evident that he would make a good carpenter with further training, and if his vision did not fail. His vision, his skill and his confidence returned to a remarkable degree, and he was obviously qualifying himself for two important things—a job as a useful member of the Royal Australian Air Force if he passed the trade test, and a training for the post-war period. His keenness increased, he lost his anxiety completely, and became admirably confident as his output of praiseworthy work increased under the guidence of the unit carpenter and the education officer who was preparing him for his trade test remuster. A final review by the ophthalmologist showed that he was visually fit to remuster as a carpenter. The patient passed the test, became a useful member of the service, and won for himself a skilled training for use after the war.

What applied in this case has applied in many similar cases and serves to illustrate the principle upon which medical rehabilitation units are founded.

The final group for discussion comes from the remaining 4% who are discharged from the Royal Australian Air Force as permanently medically unfit. Such patients are further divided into two smaller groups: those who are the responsibility of the repatriation authorities (injuries accepted as "war-caused") and those who have suffered disabilities which are not allowed as "war-caused". It is not the province of this paper to discuss the means by which these two groups are rehabilitated to civil life; but the regional committees, set up in each State by the Commonwealth Reconstruction Training Scheme and the Ministry of Post-War Reconstruction, are doing splendid work for discharged servicemen returning to civil life. Teams of experts on these committees comprise, as it were, a vocational reestablishment team, contribute medical, social, vocational and industrial knowledge, and can assess a discharged member's occupational future with accuracy and recommend the man to the employer with confidence. There are many difficulties yet to be faced, not the least of which is the lack of one central authority to take over the rehabilitation of those members whose disabilities are not "war-caused". These men have a serious economic problem to face, especially if they are not officially accepted as being the responsibility of the Repatriation Department.

Summary.

Medical rehabilitation units within the Royal Australian Air Force have undoubtedly proved their value in terms of manpower returned to active service in the shortest possible time. They have acted as repair and salvage units with human life as their material. The actual time from "reporting sick" to reporting "fit for full duty" has been reduced overall by at least 100%, and effectiveness by an equivalent amount.

In these units there has taken place a return to health under optimum conditions. Members of the Royal Australian Air Force have retained their service outlook and

not exhibited the degree of deterioration that was formerly the case.

Effective rehabilitation teams have been established in order to deal with the patient as a real person, to get the best from him as a combatant within the Royal Australian Air Force, and in the event of his having to be discharged as medically unfit, to prepare the ground for his final rehabilitation so that he may take his place in the community of happy, useful citizens of Australia.

ACKNOWLEDGEMENT.

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THE ALLERGEN OF HOUSE DUST.

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IT has long been noticed that environment has a pronounced effect on some asthmatic patients, so that they may be subject to frequent attacks perhaps in a certain town, and yet whilst in the purer air of some adjacent locality they may remain free of all symptoms. It is probable that physical factors, such as humidity, barometric pressure and temperature, play a part in this phenomenon; but the evidence now seems conclusive that the dust content of the air is the important factor. For many years it was recognized that certain subjects could be upset by pollens and by special dusts, such as those from feathers, kapok and emanations from domestic animals; but in many cases the precipitating cause of attacks remained obscure until Cooke[1] showed that house dust contained some substance which could cause attacks in certain asthmatics and which produced a typical allergic weal when tested on the skin of these hypersensitive subjects. Only house dust contains this ingredient which produces a skin reaction; it is absent from street dust and from dust from unused lofts and empty buildings. At first it was naturally concluded that this "activity" of house dust was due simply to a mixture of all the other allergens in it; but Cooke,[1] after studying the matter, concluded that it appeared to be due to some hitherto unrecognized constituent, and that it did not coincide with any other known allergen. Most asthmatic patients show skin reactions to at least two or three substances; but, after hundreds of dust-sensitive patients had been tested, it became obvious that house-dust sensitivity was not constantly associated with any other forms of hypersensitivity. More recently, neutralization experiments have confirmed the fact that house dust contains some unique allergen (Wagner and Rackemann[2]).

There is still much variation of opinion about the incidence and significance of allergy and the effectiveness of treatment by desensitization, and this is partly due to the uneven and poor quality of the extracts of allergens used in testing and treatment. The advantages of having stable, potent extracts of all known allergens are obvious, and numerous workers have attempted to evolve really satisfactory methods of preparation. However, the task has turned out to be anything but simple, and several technical problems still remain to be solved. For instance, the active fraction of many allergens is unstable and can be treated only by the gentlest methods. Intensive study of certain allergens has shown that they contain several distinct chemical substances, all of which are active, but that some subjects react to one fraction and some to another (*vide infra*). Even the chemical nature of allergens is in doubt. Early work suggested that all allergens were proteins; but several apparent exceptions to this theory have been found, and it now seems likely that, although the activity of some allergens may reside in the protein part, the specific activity of others may be determined by complex carbohydrate molecules, loosely linked to proteins or polypeptides. One difficulty is that biological tests (skin tests in patients and sensitization tests in animals) are far more delicate than any ordinary chemical tests, and even when a solution gives no reactions indicating the presence of protein, one cannot be sure that it is not there in high dilution. Perhaps the worst difficulty of all is the fact that no easy method is known for detecting small differences of activity in similar solutions.

Hypersensitivity to house dust occurs so commonly and is of such importance that the writer has for many years felt that it would be well worth while attempting to obtain a much purer and more potent preparation of the allergen, and in 1942 (Sutherland[3]) it was found that a very active fraction could be adsorbed from aqueous extracts of house dust on finely divided benzoic acid. This extract proved useful in investigation and most effective for treatment; but the point of special interest was that it failed, after further purification, to yield any reactions for protein and appeared to consist largely of a polysaccharide. The war interrupted these investigations, but recently facilities became available for further work. A review of the available literature shows that most of the workers interested in the chemistry of allergens have concentrated on those of pollens, although a few have studied house dust and kapok, and most interesting work has been done by Spies *et alii*[4] on the allergens of cotton-seed. It is probable that, as in the case of bacteria, the chemistry (and perhaps immunology) of each allergen has certain individual characteristics; but many of the methods used with pollens and other allergens are adaptable to the study of the allergen of house dust. Even the chemistry of bacterial antigens may have some applications, and if the active substance proves to be a polysaccharide, studies of other biological polysaccharides may be of interest. A review by Newell[5] contains much information on the chemistry of pollens and should be read by all those specially interested in the subject.

The Sources of the Allergen of House Dust.

Various surmises have been made as to the source of the allergen of house dust, but this is still a mystery. Clues might be obtained by a study among dust-sensitive patients of associated reactions to other allergens; by *in vitro* or *in vivo* neutralization tests (by means of passive transfer of hypersensitivity by means of serum from dust-sensitive patients); by study of variations in severity of symptoms with season and environment among these patients; by sensitization experiments in animals; by detailed consideration of all the constituent particles of house dust; by isolation of the active fraction in a pure form, and by study of its chemical and biological properties.

All house dust-sensitive subjects appear to be sensitive to at least one other allergen. For instance, a large proportion react to feathers, and smaller numbers to animal danders, kapok, orris root, linseed and pollens and other well-known allergens. However, Rackemann[2] stated that "no factor which is common to dust and other allergens has so far been demonstrated. No other test accompanies the dust reaction invariably." Cohen *et alii*,[7] noting that the active material is widely distributed in the world, suspected moulds as a source, but satisfied themselves that moulds grown on laboratory media had no specific activity on dust-sensitive patients. They then found that extracts from cotton linters from an unopened bale produced reactions in dust-sensitive patients, and they held that

linters extract would neutralize the antibodies in the serum of dust-sensitive patients. They noted also that the antigen in cotton linters differed from that of cotton-seed, that very fresh linters produced no reactions in dust-sensitive patients, and that activity developed with aging even in autoclaved linters. They believed it probable that the dust allergen could also develop with aging in substances such as kapok and feathers. The work of G. T. Brown[10] seemed to show that neither the moulds nor bacteria from cotton and kapok mattresses would produce reactions in dust-sensitive patients, nor did cotton and kapok exposed to these organisms develop any activity. Conant *et alii*[9] found many moulds in pillows, mattresses and furniture, and especially in kapok, but no special mould was found constantly. Wagner and Rackemann[10] stressed the importance of the combination of kapok and moulds. They noted that steam sterilization altered kapok in some way so that moulds did not grow well on it. Cazort[11] agreed with Cohen *et alii* regarding the importance of cotton linters as a source of the allergen of house dust, and Cohen *et alii*[12] sensitized guinea-pigs and produced shock in them with a cotton linters extract which produced specific skin reactions in over 90% of their patients sensitive to house dust. These authors showed that cotton linters were antigenically different from cotton seed. Coulson and Stevens[13] sesitized groups of guinea-pigs with cotton linters and house dust respectively and found that, although they could not demonstrate a single characteristic antigen in house dust, it contained antigens common to cotton linters, egg white and wool.

Wagner and Rackemann,[2] after studying "crossed reactions" in passively sensitized sites, concluded that "house dust, kapok and feathers do not contain any common principle . . ." Albert, Bowman and Walzer[14] studied the skin reactions in 54 atopic patients and found that "in every instance where dust reagins were found, reagins were also present to some other dust-producing inhalant such as wool, feathers, goat, silk, cottonseed, flaxseed, kapok, pyrethrum, horse, cat, dog and rabbit dander". Walzer[15] reviewed the literature of the dust allergen and concluded that its nature was still unknown, that it was doubtful whether the allergen was a single, distinct entity, and that skin tests with dust extracts must be properly controlled. He insisted that it was essential to demonstrate the presence of reagins by passive transfer in proof of true hypersensitivity, and he criticized the work of Cohen *et alii*[12][13] on the ground that they failed to remark on the irritative effects of extracts of cotton linters, which had been noted by other observers.

It is obvious that a clear-cut picture of this aspect of the problem is obscured by the defects and difficulties of skin tests, by irritant substances in extracts of allergens, and by errors in technique. Perhaps the most convincing evidence in favour of the idea that the allergen of house dust is unique, is the fact that clinicians who use the scratch test as a routine measure see no constant association of reactions to other allergens among the hundreds or thousands of subjects who react maximally to house dust.

The dust of houses must have changed considerably in quality and quantity with the passage of centuries, and now with each decade it alters appreciably. One writer has complained that the hazards of the factory will soon be equalled by those of the home, with its dyed fabrics, insecticides, and novel lacquers, paints and polishes for floors and fittings.

A large proportion of dust is carried in from the streets on boots and clothing or is blown in by the wind; lighter matter, such as pollens and mould spores, drift in even if there is little air movement. Inside, the dust comes from woodwork, plaster, paints and varnishes, furniture, carpets and other fabrics, bedding, insecticides, polishes, epithelial debris from humans, domestic animals, rodents and insects. Furnishings contribute wool, cotton, kapok, silk, jute, flax, goat and cattle hair and feathers.

Dust *en masse* has a characteristic sour odour accentuated by wetting. Microscopic examination reveals numerous coloured fibres from carpets, curtains and other fabrics, and these coarser ingredients prevent examination with higher powered objectives. Dust is difficult to sieve; but if it is thoroughly defatted by washing in ether (it contains 15% to 20% of fatty substances), it can readily be graded with a series of sieves, and that fraction retained by 200 mesh is of particular interest, especially if the fraction which floats on chloroform is used. Most of the particles are amorphous and unidentifiable, but some samples contain a surprising proportion of what appear to be epithelial scales. When this finely sifted dust is stained, many transparent particles are seen to be crammed full of bacteria. These particles resemble fragments of mucus seen in fæces, and they may be in fact from the fæces of insects or rodents. Numerous other particles can be identified as coming from vegetable fibres, feathers, animal hairs, flowers and insects.

It is of interest that some patients suffer attacks only in certain houses, and certainly samples of dust from different houses appear to have considerable differences in potency. Street dust and dust from uninhabited lofts generally show no activity, and it would seem that the most potent samples come from those houses which are most lived in, especially old houses, although no accurate quantitative data are available. It is possible that this is connected in some way with the finding of so much epithelial debris. Further clues as to the nature of the allergen are given by the fact that the condition of most dust-sensitive patients is apparently worse in the late summer, and strikingly better in mountains and in certain country localities, especially dry and warm districts. There is some evidence that house dust from these favourable spots contains less of the active substance, but this aspect requires further investigation. It is conceivable that the allergen of house dust is produced out of doors, is destroyed fairly rapidly by the weathering effects of rain and sun, but is preserved in the sheltered environment of houses. Certainly a proportion of dust must remain in houses almost indefinitely. Another possibility is that the allergen is produced by interaction between several ingredients in the dust under special conditions, just as kapok (inert when quite fresh) gains in activity with aging and the action of moulds *et cetera*.

Whatever its origin, the allergen of house dust is found widely distributed throughout the world, and although some localities appear to yield more potent dust than others, qualitative tests carried out by the writer indicate that asthmatic patients in Britain, North America, Australia, India and Ceylon react as well to local house dust as to dust from other parts of the world. However, when a dependable method for the accurate comparison of activity of allergens is found, this aspect should be studied more thoroughly.

The Preparation of Extracts of Allergens.

It is not proposed to discuss exhaustively in this article the methods of preparation of extracts, but the principal methods used will be briefly indicated.

In 1911 Noon[17] placed pollen in distilled water, and after freezing and thawing the mixture, filtered the extract and sterilized it by boiling in sealed ampoules. Lowdermilk[57] substituted normal saline solution for water, and Coca[58] used an alkaline extracting fluid, containing sodium bicarbonate (0·275%), sodium chloride (0·5%) and phenol (0·4%). This fluid is still extensively used in extracting pollens and house dust, but it has the disadvantage that it is decomposed by heat and must be sterilized by filtration. The buffered saline solution proposed by Evans[59] (sodium chloride 0·5%, potassium phosphate 0·0363%, disodium orthophosphate 0·1432%, phenol 0·4%, in distilled water) is stable on boiling and is often used in the extraction of substances such as animal epithelium. Other workers have used varying concentrations of sodium chloride, glucose, glycerine and alcohol in water. As a rule the dry raw material (pollen, feathers, dust *et cetera*) is freed from fatty substances by extraction in ether and other solvents, and is then extracted in the appropriate fluid. Some extracts are purified by dialysis, and sterility is ensured by filtration and by the addition of phenol, "Merthiolate" or other antiseptic. Generally, standardization has been attempted by the estimation of the protein nitrogen content.

Aqueous extracts prepared in this way must contain many impurities, and several efforts have been made to

obtain purer preparations. In 1913 Clowes,[60] by the addition of acetone, precipitated an active fraction from an aqueous extract of pollen, and in 1924 Baumann, Chudnoff and MacKenzie[61] extracted pollen with a 3% solution of ammonia and precipitated an active fraction from this solution with acetone. In 1940 Boatner, Efron and Dorfman[62] used water-miscible organic solvents, such as dioxane, isopropanol and acetone to precipitate a very active fraction from aqueous solutions of house dust, and they further purified aqueous solutions of this fraction by dialysis and reprecipitation with solvents and salts such as ammonium sulphate.

Some allergens in solution are labile, whereas others, such as horse dander, are relatively stable and will remain potent for years even at room temperature. Obviously it is important to find out how labile each allergen is, so that the most effective methods can be applied in purification. Great improvements have been made in recent years in methods for the isolation of labile organic compounds, and it should be possible to employ these more extensively in studying allergens. A knowledge of the precise chemical nature of allergens will, of course, facilitate the preparation of extracts.

Standardization.

No simple and accurate method exists for the assay of the potency of extracts of allergens. The position has been well summarized by Arbesman and Eagle[16] and by Newell.[5] The best method would be to isolate the active fraction in a pure form and to make standard extracts on a weight/volume basis. However, at present no allergens, with the possible exception of some of the constituents of cotton-seed, have been isolated as homogeneous substances, and it seems certain that pollens, linseed and cotton-seed, for example, contain several active and chemically dissimilar components which react differently on different patients. If one tests each of the active fractions from ragweed pollen on a number of subjects, all of whom react to the untreated whole pollen, it is found that some react strongly to certain fractions and some to others. Similar findings apply to linseed (flax-seed) and to several other allergens. This complicates the problem and seems to make purification less desirable for clinical purposes and standardization much more difficult. However, only a few allergens have been intensively studied, and it is possible that many owe their activity to a single substance.

Two principal methods have been used in attempting to standardize solutions. Noon[17] described his unit as that quantity of pollen toxin contained in one microgramme of phleum pollen; but it was later shown that the activities of different samples of pollen varied with age, season and the locality in which they were grown, and Noon's method is not now commonly used. Cooke[18] and Cooke and Stull,[19] assuming that the active fraction was protein, standardized extracts originally by estimating the total nitrogen content of extracts, and later modified the method by estimating the amount of protein nitrogen precipitated by phosphotungstic acid (the unit was 1/100,000 milligramme of this protein nitrogen). However, as has been pointed out by Newell,[5] phosphotungstic acid will precipitate allergically inert substances, such as the basic amino acids, urea and some ammonium compounds, so that, even if it were certain that the allergen was a protein, this method would not give an accurate measure of activity. Hubbard and Osgood,[20] also assuming that the allergen was a protein, held that they obtained a more accurate measure of activity by estimating the amount of protein precipitated by trichloracetic acid in a 60% solution of methanal.

Clock[21] proposed to use complement fixation as a means of standardization, but this method was abandoned when it was shown that the result often bore no relation to the allergic activities of the pollens.

In a comparison of the activity of two extracts it was originally assumed that tests with serial dilutions (1/10, 1/100, 1/1,000) of each of the extracts on a sensitive subject should give accurate information regarding the relative activities of the two; but trial has shown that it is difficult to obtain more than a rough estimate by this method. Most of the comparisons have been made by intradermal tests, and Harsh and Huber[22] are of the opinion that a more accurate comparison can be made if scratch tests are used instead. The experience of the writer tends to confirm this; but, even so, it is disappointing to find that the method gives only an approximate estimate of potency. Apparently the only method which is moderately accurate is that of Cooke *et alii*,[23] which uses the method of passive transfer of Prausnitz and Kustner[24] and estimates the minimal quantity of extract necessary to neutralize *in vitro* a constant quantity of serum from a suitable sensitive subject. This method presents several difficulties, and there is no doubt that the wholesale injection of samples of serum (even when filtered) into other patients is objectionable when one considers the recently discovered facts regarding virus diseases, such as infective hepatitis.

This impossibility of accurately and easily assaying activity introduces a serious difficulty in researches aimed at improving extracts of allergens, since at each stage of a new process products must be compared. However, the scratch test is useful in deciding which fractions are active and which inert; it is in a comparison of the properties of two fairly active samples that the deficiencies of the method become apparent. Apart from this aspect, it seems necessary to stress the defects of present attempts at standardization. Certain commercial extracts are still labelled as containing so many units per mil, and physicians unfamiliar with the facts may, in changing to a new batch of some potent allergen, give a gross overdose. Until some better method of standardization is found, the unreliability of "units" should be clearly indicated on the labels.

The Chemical Nature of Allergens.

The careful work of Kammann[25] seemed to show that the active substance of pollens was a protein, and a survey of the literature shows that, until recently, a majority of workers have assumed that all allergens are proteins. In fact, extracts used for diagnosis and treatment of allergy are commonly referred to as "protein extracts". However, Cooke,[1] in describing his discovery of an allergen in house dust, stated that ". . . these extracts cannot be standardized satisfactorily by nitrogen content and the nitrogen determination has only a relative value". Then Grove and Coca[26] held that removal by means of tryptic digestion and dialysis of all protein and other digestible nitrogenous substances from pollen and house dust extracts caused no appreciable lessening of the activity, and that therefore the active fraction seemed not to be a protein in the ordinary sense. Although this work was criticized by several workers, Black and Moore[26,28,29] supported this view and described treatment with protein-free pollen extracts (Black and Moore[27]). Black[29] held that the activity of pollen did not depend on its protein content, and made the following comment:

> The objection has been raised to the work of Grove and Coca and of Black that there may remain some protein in the so-called "protein-free" extracts. It may now be equally pertinent to remark that there may be some carbohydrate remaining in the protein fractions. Certainly the work done upon carbohydrates in bacteria demonstrates their immunologic importance.

Using the method of Ando, Black isolated from ragweed a polysaccharide which was active and reacted specifically.

Stull, Chobot and Cooke[30] obtained from pollen a substance soluble in water, in 70% strength alcohol and in hot 95% strength alcohol, which appeared to contain all the activity of the pollen. It contained reducing substances and gave frothy aqueous solutions, and these authors surmised that it might be "a polysaccharide of glucosidic nature possibly of a saponin type". However, in 1932 the same authors[31] attributed the activity of giant and low ragweeds to an albuminous fraction and were emphatic that the only active fraction from timothy grass pollen was an albuminous protein similar to that of ragweed.[32] They also noted that the allergically active fraction of dust appeared to contain a similar substance. Stull, Cooke and Tennant[33] pointed out that chemical tests for protein were not nearly so delicate as biological methods of detection. For instance, dilution of the purified protein from pollen so that the solution contained only one part of nitrogen in ten million produced skin reactions in moderately sensitive subjects. Northrop and Kunitz[34] showed that solutions of pepsin

and trypsin (both proteins), containing less than one microgramme of protein nitrogen per mil, had accurately measurable enzymatic activity, although they gave no protein reactions. It has also been pointed out that animal and vegetable proteins differ in certain properties; the latter, for instance, require more prolonged treatment with enzymes for their complete hydrolysis. Harsh and Huber[32] showed that prolonged peptic and tryptic digestion caused a marked loss of activity of giant ragweed pollen, and they concluded that their work "showed that the major part of the activity of giant ragweed pollen is due to a digestible protein, to some substance inseparably associated with it or to some substance active only in the presence of protein".

Spain and Newell,[36] by ultrafiltration of aqueous extracts of house dust, obtained an active fraction which gave only a doubtful biuret reaction and a strong Molisch reaction, indicating that it consisted largely of carbohydrate. In the same journal Wagner and Rackemann[9] noted that the active fraction of old kapok contained a polysaccharide and that its molecule was sufficiently small to diffuse through number 1200 "Cellophane".

On the other hand, Spies *et alii*[4] isolated an active fraction from cotton-seed, which consisted of a mixture of protein and polysaccharides. They attributed its activity to the protein fraction and obtained a crystalline picrate of this protein which was also active. It thus appears probable that the activity of one allergen may be due to a protein component and that of another to a complex carbohydrate. It may ultimately be found that, as in the case of some bacterial antigens, the activity of many allergens resides in a protein-carbohydrate complex.

The Size of the Molecule.

Abramson, Engel and Moore[38] concluded that ultracentrifuge and diffusion technique indicated that all the active fractions obtained from timothy pollen by electrophoretic fractionation were of small molecular size compared with ordinary proteins. Walzer's experiment[37] also suggests this. Abramson, Moore and Getner[39] studied pollen solutions with the ultra-centrifuge and calculated that the molecular weight of the active substance was about 5,000. Sangar[39] thought the molecular weight was less than 17,000. Many proteins have a molecular weight of 35,000 or some multiple of that number. Wagner and Rackemann[9] found that the active fraction of kapok diffused out of a number 1200 "Cellophane" bag during dialysis. Benjamins *et alii*[40] reported that filtration through an "ultrafein filter" removed the activity of pollen extracts, but that it was restored by the addition of substances such as glucose, glycerol and proteins. Long and Teller[41] and Hecht *et alii*[42] have done work tending to confirm this somewhat surprising finding.

Stability.

Many allergens appear to be unaffected by being heated at 60° C. for an hour; but opinions differ regarding the effects of higher temperatures. For instance, Efron[43] stated that the allergen of house dust was quite stable and its activity was only slightly diminished by autoclaving in solution for twenty to thirty minutes at a pressure of thirty pounds. He could produce inactivation only by autoclaving the solution with N/10 caustic soda solution for twenty to thirty minutes. On the other hand, Arbesman and Eagle[44] found that ragweed pollen extract was highly thermolabile and that it lost 50% of its reagin-neutralizing activity after half an hour at 56° C.

Most workers agree that allergens are generally more stable in weakly acid solutions and that they rapidly lose activity in alkaline solution. Gay[45] considered that allergens were more labile when in dilute solution.

Losses by Adsorption and Filtration.

The activity of extracts of allergens is generally reduced by shaking them with adsorbents. Moore and Moore,[46] working with pollens, found that charcoal was the most effective, followed by iron oxide and alumina gel. Diatomaceous silica and silica gel appeared to cause no loss of activity. Stull *et alii*[33] noted that repeated Seitz filtration reduced the activity of pollen extracts, and Osgood and Hubbard[47] also found this to be the case with ragweed pollen.

The Polysaccharides.

Recent work has shown the great importance of polysaccharides in physiology and immunology. Heidelberger and Avery[48] showed that the capsule of "smooth" pneumococci contained a specific polysaccharide, which although not antigenic, gave specific precipitation in high dilution with antiserum of rabbits immunized against the corresponding strain of pneumococci. Since then the chemistry and the immunological properties of the polysaccharides from many bacteria have been intensively studied and, since it is possible that the active fractions of some allergens are polysaccharides, the methods used in purifying and studying these bacterial products are of interest.

The specific polysaccharide of the pneumococcus is colloidal and strongly acidic, its micellar weight is 1,000 to 5,600, and it is built up largely of aldobionic acids.[49] Similar types of polysaccharides have been isolated from many other bacteria and fungi.[50]

In isolating the specific polysaccharide from the dysentery (Shiga) bacillus, Morgan[51] used several organic solvents, such as ethyleneglycol, diethyleneglycol and formamide, in which most proteins were insoluble, but which dissolved most of the bacterial polysaccharides.

Freeman,[52] in studying methods of isolating the specific polysaccharide of *Bacterium typhi-murium*, compared Morgan's method involving tryptic digestion with Boivan's method of extraction in cold trichloracetic acid, and he recommended the former procedure. Felton, Kauffman and Stahl[53] used precipitation by calcium phosphate, and they describe calcium phosphate as the specific adsorbent of complex carbohydrate, although according to Sumner and Somers[55] this salt is also a suitable adsorbent for proteins such as enzymes. Humphrey[54] purified the polysaccharide hyaluronic acid by repeated extraction with a 90% phenol solution, and repeated precipitation from aqueous solution with 1·25 volumes of ethanol saturated with potassium acetate. Crystalline barium salts of the polysaccharide heparin have been prepared (Myer and Chaffee[56]) by extraction with barium acetate solution, precipitation with a 20% ethanol solution and reprecipitation with five volumes of glacial acetic acid.

Polysaccharides occur in many tissues, and such biologically important substances as blood group A specific factor have been so identified.

The significance of polysaccharides in immuno-chemistry has recently been reviewed by Morgan,[50] who makes the following statement:

> It seems probable, therefore, that a bacterial antigen as it exists in the intact bacterial cell is not a simple compound of rigid chemical composition, but consists of a labile molecular aggregate possessing an essential component—such as a polysaccharide—of definite chemical structure and fixed composition, which determines the strict specificity of the antigen together with the loosely bound constituents which endow the essential component with antigenic properties. Only part of these physically associated molecules are necessary for the manifestation of the specific antigenic properties, and certain of these constituents can be dissociated from the labile complex during the isolation and purification of the antigen without producing more than a moderate reduction in the antigenic capacity of the active material. More thorough physical disaggregation of the polymolecular complex into single types of molecules will lead to complete loss of the original antigenicity that gives rise to the homologous immune body.

Support for this conception was obtained by showing that the polysaccharide could be recombined with the conjugated protein, and this complex formed an antigen which could give rise to antibodies specific for the polysaccharide component. Neither component showed any antigenic properties when tested alone. Furthermore, the specific polysaccharide of one organism will combine with the conjugated protein of another of a different species to form an antigenic complex. This work suggests that sensitization of the human subject is due to absorption of a similar

type of large, labile, molecular complex and that the substance producing the skin reaction (apparently a polysaccharide in some allergens, and known to be non-antigenic) is only part of the aggregate, although determining its specificity. It also suggests that it may be possible to aggregate the specific polysaccharide with a suitable protein to produce an antigen which might afford a new means for studying allergic phenomena and for standardizing extracts.

Observations on an Adsorbed Fraction of House Dust.

In the manner previously described (Sutherland[32]) a very active fraction may be obtained from an aqueous extract of house dust by adsorption on benzoic acid. This adsorbed material, when dried, is a light brown powder which dissolves readily in water to form a 1% solution, but when an attempt is made to form a 10% solution much material remains undissolved and the supernatant solution can be cleared only by prolonged centrifugation. The addition of two volumes of acetone to this clear, brownish solution produces a flocculent precipitate, and the substance may be purified further by repeated solution in water and precipitation by acetone. The purified material shows appreciably greater activity than the original adsorbate, and a saturated solution gives no reactions for proteins, although the original solution gave a slight precipitate with 10% sulphosalicylic acid. Molisch's test produced a strongly positive reaction. The dried material is also readily soluble in formamide and diethyleneglycol. When dissolved in phosphate-buffered saline solution (pH 7) and sealed in capillary tubes, the crude adsorbate from benzoic acid showed no appreciable loss of activity after being boiled in water for an hour, but activity disappeared completely after it had been autoclaved at fifteen pounds pressure for twenty minutes. Filtration of 1% solution through a Seitz pad caused considerable loss of activity.

Goebel[33] has described a method of isolating a polysaccharide (group A specific substance) from peptone after precipitating proteins by Sevag's method,[34] and this method was applied to an aqueous extract of house dust. Although aqueous extracts of house dust give only a slight precipitate with reagents such as sulphosalicylic acid, Sevag's reagent (butyl alcohol in chloroform) produced an appreciable precipitate, but this was found to have little activity when tested on sensitive subjects. The remaining soluble fraction, which produced reactions for polysaccharides, showed considerable activity when tested on sensitive subjects and was inert when applied to normal controls.

Clinical Observations.

Scratch and intradermal tests on dust-sensitive subjects show that the adsorbed fraction is remarkably active, and it is non-irritant when tested on normal subjects. When used for therapeutic desensitization even a 1 in 10,000 dilution causes local reactions at first, with much itching and swelling; but tolerance is rapidly established, and it is usually possible to reach a final dose of one mil of a 1% solution. When there are no complicating circumstances clinical improvement is usually rapid, and some patients treated in 1942 have remained almost completely free from symptoms. However, more extensive trial will be necessary before the efficacy of the adsorbed fraction can be assessed. It is of interest, however, that when associated hypersensitivity to such things as feathers, kapok and animal danders is not pronounced, desensitization with the house dust adsorbate alone appears to be as effective as treatment by multiple desensitization.

Tests on more than a hundred patients sensitive to house dust have shown no evidence of correspondence with any other allergen. Undoubtedly dust-sensitive patients do react frequently to feathers, kapok and cotton-seed, but occasionally cases are found in which one of these allergens alone produces a reaction. So far, all the evidence suggests that house dust contains some unique allergen. All patients who reacted to a scratch test with crude defatted dust showed larger reactions to the more refined adsorbed fraction.

An attempt is being made to complete the purification of the allergen of house dust and to study its physical, chemical and immunological properties. It is hoped that methods evolved in the purification of this allergen can be adapted to the production of improved extracts of other allergens.

Summary.

1. The literature relating to the chemistry of allergens has been reviewed, with special reference to the allergen of house dust.

2. Further observations have been made on the active fraction of house dust obtained by adsorption methods.

3. A polysaccharide-containing fraction isolated from house dust after removal of proteins shows considerable activity.

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Reports of Cases.

SERUM INCOMPATIBILITY AS CAUSE OF TRANSFUSION ACCIDENT.

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NON-HÆMOLYTIC systemic reactions occur in 5% to 15% of all transfusions with compatible blood. It is generally assumed that the majority of these reactions is caused by accidental contamination of the transfusion fluid or apparatus by foreign protein or pyrogens.

Occasionally true allergic reactions against plasma constituents have been described.[1] Recently Cumley and Irvin[2] reported experiments in which the individual specificity of human serum could be demonstrated. Incompatibility of serum and plasma constituents has therefore to be considered in transfusion accidents of a non-hæmolytic nature. The following case report illustrates this point.

Clinical Record.

Mr. C.C., aged thirty-five years, entered hospital because he noticed a tendency to bleed spontaneously or after small cuts. He had been exposed to acetone, ethyl formate and toluene. No history of allergy could be elicited. A blood examination on July 7, 1944, revealed that the erythrocytes numbered 4,500,000 and the leucocytes 3,200 per cubic millimetre; the hæmoglobin value was 91%. A further blood examination on July 19 revealed that the erythrocytes numbered 2,700,000 per cubic millimetre and the hæmoglobin value was 55%. The blood belonged to group A_2 and was Rh-positive.

Five hundred millilitres of citrated blood were given without incident on July 19. Bone marrow taken by sternal puncture on July 24 was aplastic. After a transfusion of 500 millilitres of blood by the direct technique on July 29, the temperature rose to 38·7° C. (101·7° F.) and the patient complained of headache, pain in the joints and shivering. Symptoms were relieved by morphine. No abnormalities were detected in the urine during and after the attack.

To elucidate the cause of the reaction, the blood was taken from the recipient and from a different donor before the next transfusion was attempted on August 4 and tested for incompatibility. No agglutination of the red cells of donor or patient could be observed in cross-matching tests performed by test tube technique at 37° C. and 4° C. When diluted serum of the donor was layered over serum of the patient, a faint but clearly marked ring of precipitation developed after fifteen minutes' incubation. Blood from the donor was citrated and given by the slow drip method. The same subjective symptoms as in the previous transfusion developed thirty minutes after commencement of the transfusion, and the temperature rose to 40° C. (104° F.). The transfusion had to be stopped. No abnormalities were detected in urine taken during and after the accident, and the icteric index of the patient's serum remained constant. It appeared that the patient was sensitive to a substance in the donor's serum which gave a faint precipitin reaction when brought in contact with the patient's serum. To confirm this *"in vitro"* observation a passive transfer test was performed, the results of which are summarized in Table I.

A further eight transfusions by direct technique, each consisting of 500 millilitres of blood, were given from different donors during the course of the illness; the blood of one of these donors was Rh-negative. All transfusions were

followed by non-hæmolytic reactions of varying intensity, which were relieved by the administration of adrenaline.

The patient died on September 3 after a severe hæmatemesis.

TABLE I.

Skin Site Prepared with	Reinjected with	Result.
0·1 millilitre of saline solution.	0·05 millilitre of donor's serum.	0[1]
0·1 millilitre of patient's serum.	0·05 millilitre of donor's serum.	+[1]
0·1 millilitre of patient's serum.	0·05 millilitre of donor's serum (1/10).	+
0·1 millilitre of patient's serum.	0·05 millilitre of donor's serum (1/100).	+
0·1 millilitre of patient's serum.	0·05 millilitre of saline.	0
0·1 millilitre of patient's serum.	0·05 millilitre of patient's serum.	0

[1] "0" = no reaction; "+" = typical triple reaction.

Summary and Conclusion.

Repeated non-hæmolytic transfusion accidents are described which were caused by an antibody in the patient's blood able to produce precipitation with the serum of different donors. Transfer of the hypersensitivity to the skin of a normal person could be achieved.

The antigen which was responsible for the accidents could not be identified. The fact that precipitation between the patient's and the donor's serum could be demonstrated and the occurrence of reactions with the blood of ten donors seem to indicate that food allergens or similar substances were not implicated.

Acknowledgement.

We wish to thank Dr. John McLean for his help with this patient.

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INTERESTING FEATURES IN A PRIMARY TUBERCULOUS FOCUS IN THE LUNG.

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THE primary complex in pulmonary tuberculosis is seldom of interest to medical men as a whole; its manifestations are generally so vague as to defy clinical detection, and the ultimate outcome of the lesion is so consistently favourable that the condition is almost universally regarded as something like chicken pox—it happens, but invariably the patient gets better, so there is no need to worry about it. Occasionally, however, one sees a patient whose symptoms, and the circumstances in which they arise, combine to lift the condition out of the ordinary; such is my reason for presenting the following clinical history and a few comments on it.

Clinical Record.

Nurse E.F.E., aged thirty-nine years, commenced duty as a nurse attendant at the Morris Hospital on May 10, 1941. This hospital, built in 1930 and situated six miles from Adelaide, is used for prolonged bed rest treatment of tuberculous patients. Nurse E., having been healthy all her life, was put on night duty without preliminary examination, so that I did not see her until she had been nursing for two weeks or so. On May 26, 1941, she failed to react to the Mantoux test with a 1 in 1,000 dilution of old tuberculin, and on May 31, 1941, an X-ray examination of her chest revealed no abnormality. On June 3, 1941, she failed to react to the Mantoux test with a dilution of 1 in 100, and on June 9, 1941, she failed to react to the test with a dilution of one in ten. On June 23, 1941, she developed a febrile illness, nausea, sore throat and general malaise.

On June 24, 1941, the sites of the three tuberculin injections for the Mantoux test, hitherto healthy, became simultaneously reddened and the typical weal developed, surrounded by an erythematous ring; the reaction was strongest at the site of the one in ten injection. This feverish condition persisted, Nurse E. remaining on duty. At the end of five days, her temperature being 101·2° F., Nurse E. "reported sick". The sites of the tuberculin injections were still inflamed and the axillary glands on the right side (the side of the one in ten injection) were enlarged and tender. The fever disappeared with rest in bed, and after seven days Nurse E. was sent to her own home for a holiday. The right axilla, however, became more and more painful, and on August 8, 1941, an abscess in this situation was opened; from the pus acid-fast bacilli resembling *Mycobacterium tuberculosis* were recovered. On the day of her visit to me, August 20, 1941, the patient felt well, and said that her temperature since the evacuation of the axillary abscess, though taken irregularly, had not exceeded 98·4° F.

Physical examination disclosed no abnormality except an enlarged gland in the right axilla and a discharging wound in the same area. Fluoroscopy revealed some abnormal opacity just lateral to the right border of the heart. An X-ray film taken at this stage revealed a fairly discrete rounded opacity, the size of a threepenny piece, just lateral to the right cardiac border. Examination at intervals of one month since that date (August 20, 1941) have failed to reveal any clinical abnormality and the X-ray appearances remain unchanged. The girl herself feels perfectly well and for the last three years has been engaged in the making of munitions.

Comment.

It appears from this history that the most important date is June 24, 1941; on this date sensitivity to old tuberculin was made manifest—sensitivity, of course, implying an altered reaction of the tissues (in the Mantoux test the tissue is the skin) to the products of the tubercle bacilli. It is obvious that at some date prior to June 24, 1941, the bacilli must have lodged in the body, and that there had subsequently been sufficient time for the elaboration of the antibody to the toxin. Since an X-ray film of the chest on August 20, 1941, revealed a primary focus just outside the right cardiac border, it appears that the portal of entry to the body used by the bacilli was the lung. However, no primary focus was found in the lung on May 31, 1941; hence infection must have occurred between May 31 and June 23, 1941, since on this latter date the sensitivity that follows infection was apparent. It is seldom that the actual date of infection and the time taken for the development of sensitization can be accurately determined; speaking from memory, I think it was a fortnight in the Lubeck disaster. In the present case three weeks (twenty-three days precisely) is the longest period over which infection and sensitization could have occurred. The period might have been shorter; it could not have been longer.

The second point of interest in the history is the persistence of the old tuberculin at the site of infection for so long. Comment was made on this point in *The Lancet* recently; I have had no previous experience of this phenomenon. It is, of course, common to see the brownish stain of a positive Mantoux reaction persisting for weeks and even months. I have, however, seen one case in which the site of a positive Mantoux reaction became reddened and swollen like the skin of a mulberry some twelve months subsequent to the date of performance of the test; the patient was a nurse engaged in caring for tuberculous patients, her health was excellent, and X-ray films (of her chest) revealed no abnormalities.

The third point of interest is the now familiar occurrence of non-reaction to the Mantoux reaction by a city woman, aged thirty-nine years. These failures to react to the test, considered in the light of Heimbeck's conclusions, are a positive bar to the engagement of the non-reactors in the nursing of consumptives, and as such are a problem to hospital authorities charged with the selection of nursing probationers.

It seems to be accepted almost universally that a positive Mantoux reactor is better off than a non-reactor if he (as a doctor) or she (as a nurse) should come into intimate contact with a patient suffering from tuberculosis of the lung. This was Heimbeck's contention years ago; it has been accepted as an important point in the staffing of tuberculous hospitals ever since, and recently has been reaffirmed by Daniels.

The final interesting point is the bacillæmia following infection, and the parts played by chance and trauma in

determining the location of sites of lodgement of the bacilli and whether or not the implanted bacilli grew in their new home. In the case of the patient in question it is inferred that a bacilliæmia occurred, else how did the bacilli pass from the lung to the axillary gland? It is probable that the material resulting from the interaction of old tuberculin (strength one in ten) with antibody at the site of the injection damaged the endothelium of the lymphatic gland, producing sinus catarrh and narrowing the lymph channel so that the bacilli were more easily trapped than usual; the arrested bacilli produced the usual results—necrosis of tissue with caseation, liquefaction and abscess formation. Since the opening of the abscess was followed by the prompt fall of temperature to normal, it is probable that the axillary abscess, not the primary lung focus, was the cause of fever, and the focus remained presumably unchanged after evacuation of the abscess.

If there had been no trauma to the gland there would have been no abscess, and apart from the sensitization the infection would have been undetectable. It is believed that trauma influences the development of tabes in a syphilitic, and again that the mechanical trauma of repeated usage determines the location of gonococci in gonorrhœa and rheumatism. How far trauma plays a part in the location of any and every metastatic focus is a point worth more study than has been given to it.

Reviews.

A YEAR BOOK OF UROLOGY.

"THE 1944 YEAR BOOK OF UROLOGY", one of the twelve volumes comprising the "Practical Medicine Series of Year Books", has been published.[1] The editor is Dr. Oswald S. Lowsley. The volume, which conforms with the rulings of the War Production Board of the United States, is divided into eight sections; there is also a special introductory article on the use of penicillin in the treatment of urogenital infections. Both authors of this article are members of the medical corps of the United States Naval Reserve and have had wide experience of the subject on which they write. They point out that the success of penicillin in combating the gonococcus has been so phenomenal that in lesions caused by this organism the drug is supplanting all other forms of chemotherapy as rapidly as supplies become available. In the treatment of non-gonococcal infections penicillin is not so effective. In fact the difference in response between gonococcal and non-gonococcal urethral infections is so clear cut that the authors are tempted to recommend the use of penicillin as a therapeutic test in the diagnosis of cases of uncertain ætiology. In non-gonococcal urogenital infections penicillin has been most effective in coccal infections of the kidney and perinephric space.

The sections of the book deal in turn with general considerations, the kidney and adrenal, the ureter, the bladder, transurethral operations, the prostate, the genitalia and gonorrhœa. The first thing that strikes the reader of the volume is the wealth of detail given in some of the synopses of work dealt with, and the excellence of the illustrations which number no less than 117. The skiagrams, the photomicrographs and the illustrations to some of the technical descriptions are of the highest order and enhance the value of the work. Some of the more interesting subjects may be mentioned. The surgical aspects of cystic disease of the kidney are mentioned as having been studied by O. S. Lowsley and M. S. Curtis; the report had not been published when the book went to press, but was to appear in *The Journal of the American Medical Association*. This is unusual in a year book, especially as illustrations have been included. The authors have studied 74 cases. Of these 19 were simple renal cysts, 53 were cases of polycystic disease and two were echinococcal cysts. Several studies of Wilms's tumour of the kidney are mentioned. C. P. Mathé's work on partial resection of the kidney is described and the technique set out with illustrations. A description is given of what is known as "intravenous urokymography", elaborated by Boland Hughes, of Pennsylvania. By this means the dynamic function of the pelvis of the kidney and of the ureter can be estimated. Tumours of the bladder have been discussed by several authors. In the section on the prostate a study by Dean, Woodard and Twombly on the endocrine treatment of cancer of the prostate is described. It is stated that the authors' findings suggest that the mechanism by which castration causes regression of prostatic cancer is fundamentally different from that of stilbœstrol. Antonio has reported satisfactory results in the operative management of five cases of hypertrophy of the prostate in which the patients were suffering from complicating coronary disease. Under the heading of genitalia many operative procedures are illustrated. In the section on gonorrhœa several diagnostic methods are discussed.

Though this volume will appeal chiefly to the urologist, there is a great deal in it that will be of value to the general surgeon.

[1] "The 1944 Year Book of Urology", by Oswald S. Lowsley, M.D., F.A.C.S.; 1944. Chicago: The Year Book Publishers Incorporated. 7" × 4½", pp. 416, with 94 illustrations. Price: $3.00, post paid. Australian price: 23s. 6d.

A YEAR BOOK OF PHYSICAL MEDICINE.

A FEW weeks ago under the heading of "Physical Medicine and its Practice in the Future" space was devoted in the editorial columns of this journal to the increased interest that is being displayed in England and America in the practice of physical medicine, a term which is gradually replacing the designation physical therapy. This year "The 1944 Year Book of Physical Medicine"[1] replaces "The 1933 Year Book of Physical Therapy". The editor, Richard Kovács, discusses the change in the introduction. He points out, *inter alia*, that under the new scope of physical medicine occupational therapy will have a recognized place in therapeutics and will be more fully under direct and keenly interested medical supervision.

The book is divided into two main parts—the first dealing with physical therapeutic methods and the second with applied physical therapy. In the first section of Part I general considerations are discussed. First of all comes an account of Lord Horder's views on the "horizon of physical medicine". The horizon is wide and includes all measures that will keep the fit, fit, and make the near-fit, quite fit. Then comes an account of the Baruch Committee on Physical Medicine, the remarkable body created by Mr. Baruch, who is not a medical man, with a gift of a million dollars. It will be remembered that the Baruch Committee repeatedly emphasized the need for more education and research in physical medicine. The remaining sections in the first part give an account of work done during the past year on the various methods, such as thermotherapy, electrotherapy, light therapy, hydrotherapy, spatherapy, climatotherapy, mechanotherapy (a very interesting section), miscellaneous procedures and occupational therapy. There is a short section on physical therapy in industrial medicine.

Part II on applied physical therapy is ushered in with a section on general considerations. First of all reference is made to the views of A. L. Watkins on physical therapy in general medical practice, and it is shown that physical measures can be used in prevention as well as treatment. This is followed by an abstract of a paper by W. C. Alvarez on "diagnostic time savers for overworked physicians". At first the reader may wonder why it has been included, but soon appreciates the emphasis laid on physical findings and the interpretation of symptoms as likely to make laboratory procedures unnecessary. One of the most important sections in this part deals with physical therapy in war and rehabilitation. There is reference to exercise for the orthopædic convalescent, to the coordination of physical and surgical therapy in orthopædic and amputation cases, to rehabilitation in the United States Army, to occupational therapy in "reconditioning", to opportunities for psychotherapy in physical therapy (worthy of careful attention), to the rehabilitation of soldiers with brain injuries and also of the blind and deaf. Rehabilitation in the British Army is mentioned and a fairly long abstract describes the rehabilitation of war wounded in the Soviet Union. Reference is made in turn to cardio-vascular conditions, peripheral vascular disease, respiratory conditions, miscellaneous medical conditions, arthritis and rheumatoid conditions, traumatic conditions, orthopædic conditions, paralysis, mental conditions. Syphilis and gonorrhœa are included, and also gynæcological, proctological, dermatological, ophthalmological and rhino-laryngological conditions. From this it will be clear that physical methods find a place in the treatment of practically all conditions and that observations on them have recently been published. In the section on rheumatism reference is made to psychogenic rheumatism and emphasis is laid on the need for psychotherapy rather than for physical therapy—an interesting ailment and sensible advice. The section on traumatic injuries contains reference to injuries from cold. Many of these have become prominent as a result of war conditions, notably "immersion hand" and "immersion foot". There are important references to sacro-iliac conditions.

[1] "The 1944 Year Book of Physical Medicine", edited by Richard Kovács, M.D.; 1944. Chicago: The Year Book Publishers, Incorporated. 7" × 4½", pp. 416, with 66 illustrations. Price: $3.00, post paid; in Australia, 23s. 6d.

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All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

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CHRONIC DISEASES AND THEIR PROBLEM.

BEFORE a medical student has been very long in the hospital wards he discovers that there are acute and chronic diseases. One of the ways in which he makes this discovery is by hearing certain patients referred to in the jargon of hospitals as "chronics". Medical folk and all who have to do with the running of hospitals know that patients suffering from chronic diseases present a difficult problem and they realize also that the problem is becoming more and more acute as public hospitals are opening their doors to a widening circle of patients. Beyond this the incidence of chronic diseases is important in the economic sphere, particularly in view of the already enormous sums of money that are being spent every year in pensions for sufferers who, because of their ailments, are permanently incapacitated from work. The word chronic as applied to disease has a long history. For example, we read that Caelius Aurelianus, of Sicca, in the fifth century A.D. translated two works of Soranus, of Ephesus, who lived in the second century. Those works dealt with acute and chronic diseases, *celeres* or *acutæ passiones* and *tardæ* or *chronicæ passiones*. Diseases may be divided into acute and chronic forms, and the acute may be divided into acute and subacute groups. A chronic disease is defined by the Oxford Dictionary as being a disease "long continued, lingering, inveterate". Use of the term often carries with it, though it should not necessarily do so, a suggestion that the disease will always be with the patient in some degree or other, that it will leave on him an ineradicable mark that will affect his comings and goings. From a subacute disease recovery is expected to occur after a shorter or longer time, and when this does not take place the patient may drift into such a state that his disease is regarded as chronic. The distinction between subacute and chronic diseases is not always observed; there is sometimes ground for suspicion that the expression subacute disease, especially in relation to subacute diseases hospitals, is a euphemism.

To make an accurate estimate of the number of persons in the Commonwealth of Australia who are suffering from chronic diseases would be extremely difficult, if not impossible. Information is available regarding the number of deaths from certain diseases, but no indication of acuteness or chronicity is given about diseases which might cause death from an acute or a chronic manifestation. Again, a person does not always die of a chronic disease from which he suffers. The only diseases with a recorded incidence are infectious diseases. Not many of these present chronic manifestations, and in any case the same diseases are not notifiable in all the States. Such a disease as tuberculosis, for example, which may occur in acute or chronic forms, is notifiable in all States, but in New South Wales and the Northern Territory only pulmonary tuberculosis is notifiable. It is therefore of interest to find that George St. J. Perrott, of the United States Public Health Service, has made an estimate of the number of persons in the United States suffering from chronic diseases. He states that each year the chronic diseases cause nearly one million deaths in the United States and one billion days of disability. Over 25 million persons suffer from some disabling or non-disabling chronic ailment. Perrott states that the amount of chronic illness in the population can be estimated with the help of available indices: the deaths caused by these diseases, the cases which occur in the population at any one time, and the amount of medical and hospital care which is given to them. He points out that there is no systematized programme for the reporting of chronic illness and disability, and that what is known about them comes from special investigations or, as he calls them, canvasses. The most extensive of these, and one on which he bases most of his discussion, was undertaken in 1935 and 1936, and was the result of a study of 2,800,000 people by the United States Health Service. If we take the population of the United States as 130 million (it was 129·8 million in 1937) and the population of the Commonwealth of Australia as 7 million (6·9 million in 1937), a similar study in Australia would cover roughly 150,000 persons. To make a survey of this number of people would not be very difficult, but to cover 150,000 persons who represented an average cross-section of the community would not be so simple. For the time being and for purposes of this discussion it may be pointed out that if Perrott's estimate for the United States is applied to Australia, the number of persons in the Commonwealth suffering from chronic disease must be approximately 1,350,000. Perrott's definition of chronic disease, stated by himself to be somewhat arbitrary, is: "a disabling or non-disabling chronic pathological condition known to the informant, the symptoms of which had been recognized for at least three months".

When chronic diseases are mentioned medical practitioners at once think of rheumatism, of heart disease and diseases of the circulatory system such as arteriosclerosis and hypertension, of respiratory disorders such as hay fever and asthma and chronic bronchitis, of tuberculosis, of cancer, of diabetes, of peptic ulcer and so on. The statement may be made that people must die of something and that the conditions named are those that may usually be expected to manifest themselves. Many persons will shrink from the idea that everyone should die of senile changes. The object of the practice of medicine is to prevent disease, and if it cannot be prevented to curtail its course, to minimize its effect on the individual and to

leave him in such an efficient and healthy state that he will be able to withstand any future infections that threaten him. This means that if disease cannot be prevented, it must be cured and chronic residua must be eliminated. The causes of chronic disease are the causes of disease generally and include particularly those conditions in the constitution and environment of the individual which prevent him from making the response that is associated with cure. Among these conditions are defective nutrition, unhealthy surroundings and states of mental unrest and anxiety. Chronic disease may be expected in the later rather than in the earlier stages of life, and it is thus apparent that in ordinary circumstances with the increasing expectation of life a further increase in the incidence of chronic disease may be expected.

The fight against chronic disease can be planned along several channels. First of all, the fight against disease in all its aspects must be continued and more attention must be paid to man's environment in leisure and at work. Treatment must be directed at the whole individual and not at his disease—this means that his whole make-up, his constitution and his mental condition must receive at least as much attention as is paid to the agent causing the disorder. Particularly will this be necessary in the period of post-war reconstruction and in Australia as well as in devastated lands. When chronic disease has appeared its treatment should be complete. In the case of certain conditions, such as rheumatism and tuberculosis, special institutions or organizations may be necessary, so that the sufferer if possible will be fitted for a life of useful, if restricted, activity. This last consideration opens up the question of vocational training and the finding of jobs suitable for persons of subnormal mental and physical capabilities. This sounds like a Utopian aim, but it can be done if the people and those who act for them in authority have the vision and the will to do it.

Current Comment.

CERTIFIED SICKNESS ABSENCE AMONG WOMEN IN INDUSTRY.

THE aim of industrial medicine is the prevention of disease among industrial workers and the creation of an environment favourable to health and well-being. The war has given an impetus to the work of the industrial hygienist, and one of the tasks of the post-war period will be to see that advances made in industrial medicine are extended. Workers in industry may be affected by illness resulting from their work or by ailments arising apart from it. Of the greatest importance in this matter is the keeping of proper records of persons affected by illness and of the disability from which they suffer. This has been shown recently in Great Britain, where the Industrial Health Research Board has published the report of a study of certified sickness absence among women in industry.[1] The author points out at the start that in the past the tendency has been to regard all absence due to sickness as unavoidable. Many employers, though disturbed by a moderate amount of casual absence, are usually less worried by a higher sickness rate. There are several facts which show that a substantial amount of sickness absence is avoidable. In the first place the absence is much less in some factories than in others doing the same class of work; secondly, the sickness varies with the hours and conditions of work; thirdly, the sickness rate is usually reduced by efficient medical and welfare services. The problem is related not only to working conditions, but also to the wider background of diet, housing, transport, leisure and other specific factors. The author found that the collection of reliable information was not easy, as a large majority of firms either kept no records of sickness absence or kept them in such a way that they were useless for comparative purposes. In some factories only certified sickness absence of more than two or sometimes three days was recorded; in some the opinion of the foreman was accepted; and in others the explanations given by the workers were thought to be good enough. Even when the records were limited to certified sickness absence, the enforcement of the rules regarding the production of medical certificates was strict in some factories and lax in others. For these reasons the author restricted his inquiry to the information in regard to certified sickness absence of two or more days supplied by factories whose method of recording was known to be reasonably accurate and complete. From five factories at which an average total number of 24,000 women were employed random samples of 1,000 were chosen. From four factories 1,000 women and from one factory 500 were selected; and from the factory records the time, duration and nature of each certified sickness absence for the six months ended December 31, 1942, were studied. The results obtained are regarded as being representative of those that would be obtained from more than 20,000 women.

It was found that for every 100 women in the sample there were on an average 84·2 cases of sickness absence in the last six months of 1942. It is explained that this does not mean that 84·2% of the women were absent through sickness, since some were absent more than once. The corresponding figures for married and single women were 98·2 and 66·3 respectively. Absences among married women are calculated as having been approximately 48% more frequent than among single women. Diseases of the respiratory system were responsible for the greatest number of absences (26% of the total). Two-thirds of these absences were due to colds and influenza. Next in order of frequency were digestive ailments, and these were closely followed by nervous disorders. By far the greater proportion (seven-eighths) of the nervous disorders were of the functional type. Absences due to "fatigue", which included cases of asthenia, general debility, general fatigue and industrial fatigue, came in a separate group lower down the list. Diseases of the locomotor system, of which about half were due to rheumatism, were responsible for 6·9% of the absences; a further 5·3% were due to diseases of the circulatory system, mainly anæmia. It is important to note the conclusion that some of the digestive diseases, as well as a number of the disabilities for which no diagnosis was given, had a nervous background. Thus "nerves" and "fatigue" probably accounted for about 20% of the total number of absences. When the grand total was calculated it appeared that the sickness absence among 20,000 women workers for the period under review amounted to 7·8% of the total number of days in the period. The percentage of women who had no sickness absence in the period of six months was 45·3 and the percentage of those who had absences of more than 28 days was 14·4. Sickness absence varied with age; the number of days lost through sickness was highest in the age group 30 to 50. In each age group there was more sickness among married than among single women, the increase being most noticeable in married women under 25. The amount of sickness varied according to the type and conditions of work. It was higher for production workers than for examiners and was least for clerical workers. There was some evidence to show that sickness absence among women on day work was less than for women working on shifts.

The author states that his results cannot be regarded as giving a complete picture of the causes of sickness in industry. Still less are they typical of industry in Australia where climatic and other conditions at the

[1] "A Study of Certified Sickness Absence Among Women in Industry", by S. Wyatt (assisted by R. Marriott, W. M. Dawson, Norah M. Davis, D. E. R. Hughes and F. G. L. Stock); Medical Research Council, Industrial Health Research Board, Report Number 86; 1945. London: His Majesty's Stationery Office. Pp. 34. Price: 9d. net.

present time are different from those of the Old Country. They do show, however, the need for the establishment of some uniform system of recording sickness as it is manifest in industrial undertakings. In this country, where a certain number of days are allowed in each year without loss of payment, the psychological effect of this provision will have to be considered, whether the sickness is certified or not. In this investigation the high percentage of certified sickness which was regarded as due to "nerves" and "fatigue" is another indication of the attention that has to be paid to the action and reaction of the nervous system in every human undertaking.

THE RELATIONSHIP OF BATTLE STRESS TO NEUROSES IN WAR.

THE unhappy term "shell-shock" has been responsible for a great deal of misunderstanding, and even during the present war there is ample evidence that too much has been made of the role of actual combat stress in the production of neuroses. No one would under-estimate the terrible stresses to which fighting men may be subjected, though it is likely that many civilians have endured strains at least comparable with these. But neuroses are more frequently due to other causes than these. Valuable contributions to this subject have already been published in this journal as in many others in other countries, and an interesting study is to hand of neuroses in the United States Navy. This study was made by Commander R. S. Schwab and Lieutenant Commander H. Rochester.[1] They distinguish very clearly between the true combat neurosis and that arising in non-combat areas in men who have not been subjected to the stress of work in combat zones. The former is caused by breakdown under exceptional conditions of fatigue, strain and fear-producing experiences. It may be enhanced or favoured in its inception by a background of mental instability, and it is, of course, of interest to know how often this is so. The true combat neuroses are to be regarded, as these authors aptly remark, as "a manifestation of military inaptitude under the total stress of war", but no attempt is made in this article to discuss any precipitating causes. Prompt and correct treatment is effective in a large percentage of cases of this type, as the experience of many medical officers all over the world shows. Schwab and Rochester point out the great importance of the recognition of the good subjects for early return to duty and the separation of the unfavourable ones from these. They have devised a special chart which shows graphically the degrees of stress and instability as causal factors, and records the degree of recovery and of breakdown. This enables the evaluation of every case to be made quickly and an opinion of the correct method of disposal to be made early. The exact method is, of course, a matter of detail and convenience, though any short cuts are welcome even in these minor actions in the paper war. What matters is that accurate and early study should be made of each individual and that great care be taken to ensure that the appraisal of each individual be checked to ensure its accuracy. In their favourable cases Schwab and Rochester send the patients early to general medical wards, and keep in psychiatric wards the severely affected whose condition is unfavourable. With the wisdom of treating such patients in general wards there can be no disagreement: it is undoubtedly essential to emphasize from the first the dissociation of the man's malady from any possibility of future nervous invalidity. The second group, the non-combat neuroses, are causing difficulty everywhere. Military discipline, restriction of life, loneliness, separation from home, responsibility and boredom are all important causes, and there is no doubt that in many cases the history indicates some degree of previous inadequacy in ability to cope with the ordinary strains of life. The authors remark that they have been struck with the better progress of such patients in ordinary medical wards. Their analysis shows that the patients who made the best recovery in this group were those who were in medical wards for the investigation and treatment of symptoms of the psychosomatic type. They also noted that the history of instability was rather less in these men, even though the evidence of stress was greater. The less favourable patients were those with complaints of more general type, with less organic fixation, but showing such signs as tremor, insomnia and tension and confessing fears of all kinds. These experiences are large-scale studies of material such as is commonly observed in ordinary practice. Circumstances have modified the manifestations, and often increased them vastly, and often, too, made the solution of the troubles difficult or well nigh impossible. Yet it is important to avoid the danger of giving the impression that in these illnesses there is some new and malign element, instead of an old problem restated.

[1] *War Medicine*, January, 1945.

THE CONTROL OF CARRIERS OF HÆMOLYTIC STREPTOCOCCI.

THE introduction of penicillin has aroused interest in other antibiotic substances, and naturally attempts have been made to use these in eradicating pathogenic organisms from the throats of carriers. Tyrothricin is one of these antibiotics, and observations on its properties suggested that it might prove of value in freeing the naso-pharynx of streptococci that had made their habitat there. The particular purpose was to make patients convalescent from scarlet fever safe to others. A group of workers from the Department of Bacteriology and Immunology in Harvard has made a special study of this problem, and the findings are presented in a recent article by G. Hartley, J. F. Enders, J. H. Mueller and E. B. Schoenbach.[1] Inmates of a home for crippled children provided the material for this inquiry. Previous experience had shown that during the winter months not only had a high proportion of streptococcus carriers been found among the children, but also streptococcal pharyngitis had been common. On this occasion a high carrier rate was again demonstrated, and the β-hæmolytic streptococci isolated from the throats were grouped and typed repeatedly, the frequent presence of Group A streptococci being proved. Over half the children in this home are bed patients, and the remainder ambulatory. The carrier percentage was much higher among the boys than among the girls. The boys were all treated by a copious spraying of the nose and throat twice daily with a suspension of tyrothricin. It was proved by *in vitro* experiments that this suspension was effectively antibiotic against the streptococci grown from the children's throats. However, the results were disappointing, for continued application of this spray for nearly three months failed to eradicate the streptococci. The authors suggest that the reason for the ineffectiveness of the tyrothricin *in vivo* was its insolubility in water and in tissues. They are probably correct when they further state their belief that the organisms are not merely resident on the mucosal surface, but penetrate into the deeper layers of the epithelium. As encouraging reports of the results of this method of treating carriers have been made previously, it may well be that spontaneous disappearance of the streptococci has occurred after a time independently of treatment. It is known that the carrier rate as determined by frequent cultural examination is subject to fluctuation. It is of some interest that typing revealed that most of the children were harbouring the same type of streptococcus, namely, type II. But in spite of the wide distribution of this organism in a closed community during the winter months, no cases of scarlet fever or pharyngitis occurred. Even when a sharp rise in the carrier rate occurred, it did not prove to be the herald of an outbreak of clinical infection.

The present incidence of scarlet fever in this country interests us in this problem, and in obstetric practice it is of the highest importance; therefore, despite discouragement, it is to be hoped that workers in bacteriology will pursue their researches.

[1] *The Journal of Clinical Investigation*, January, 1945.

Abstracts from Medical Literature.

PATHOLOGY.

Cardiotoxic Substances in the Blood and Heart Muscle in Uræmia.

W. RAAB (*The Journal of Laboratory and Clinical Medicine*, July, 1944) reports that blood and heart muscle of uræmic patients were found to contain excessive amounts of catechol compounds of probably adreno-sympathetic origin. These findings were roughly paralleled by the presence of anoxic electrocardiographic changes and signs of cardiac failure. The serum of uræmic patients displayed specific, strikingly toxic effects on the isolated frog heart and on the heart of the intact rabbit. Analogous effects were reproduced experimentally by various known catechol compounds and in part also by phenols. Both catechol and phenol compounds are believed to participate significantly in the chemical mechanism leading to cardiac failure and death in uræmia.

The Mode of Origin of Tumours.

RUPERT A. WILLIS believes that the evidence he presents in a paper in *Cancer Research*, October, 1944, justifies the view that squamous cell carcinomata of the human skin are comparable with those produced experimentally, and are the products of the following sequence of events. A skin field more or less extensive has been subjected to a succession of carcinogenic stimuli (still often unspecifiable in human beings), which have induced slow progressive changes in both the epidermis and dermis of that field. With the passage of time the epidermal changes become structurally apparent as precancerous hyperplasia, which may persist innocuously as such for long or brief periods. The dermal changes include gradual increase, followed by degeneration of elastic tissue just below the epidermis. In this precancerous field there is often a visible gradient of both epidermal and dermal changes, usually from a single central focus to the periphery, but sometimes with more than one focus of high cancer potential. At the central focus (or at several high potential foci) of the field, hyperplasia passes into irreversible neoplasia, with or without immediate invasion of the dermis by the epithelium. Invasion probably commences at points of maximum damage of the dermal elastic tissue. As cancerous proliferation and invasion progress at the central part of the field, cancerous change of the surrounding unstable epidermis takes place in a steadily enlarging area around the centre. It is at this stage that early carcinomata of the human skin, like those described, become available for study. After the entire field of the predisposed epithelium has become cancerous, the tumour enlarges solely by proliferation of the cancerous cells, and structural evidence of its mode of origin is soon lost. Some pathologists, while properly recognizing that tumours often arise by spreading cancerization of a more or less extensive field of tissue, have assumed this to be brought about by "the passage of a malignant influence from cancer cells to adjacent non-cancerous epithelial cells, whereby the latter are induced to become cancerous *in situ*". However, there is no need to create a stumbling block by supposing any such "malignant influence". In human as in experimental carcinogenesis the effective stimuli are applied, not to one cell or one small group of cells, but to a more or less extensive area of epithelial tissue. All the epithelium in that area is acted upon similarly, though, of course, usually not equally. Neoplasia will commence where the stimuli have been maximal, but the neoplastic response will later be manifested by neighbouring tissue that was subjected to the same original stimuli. The timing and distribution of this progressive response will depend on the distribution and intensity gradients of the causative stimuli.

Pathological Anatomy of Atypical Pneumonia of Undetermined Ætiology.

THE anatomical lesions of acute interstitial pneumonitis have been studied by Alfred Golden (*Archives of Pathology*, October, 1944) in a large number of cases in which death from "atypical pneumonia, etiology undetermined" occurred. There were variations in the morbid anatomy in this series of cases; but certain changes were common to all cases. There was acute bronchiolitis, focally distributed, in which desquamation of the mucosal surfaces occurred early. The lumina of the affected bronchioles contained frank pus, mucoid fluid and desquamated epithelial clusters or single cells, sometimes in an advanced stage of disintegration. Bacteria in small numbers and not of uniform type could be demonstrated in the bronchiolar pus in some cases; in most cases none could be found. The bronchioles were dilated, sometimes greatly dilated, even where death occurred early in the disease. The walls of such bronchioles were infiltrated chiefly with mononuclear cells, which extended radially into the regional interstitial tissues of the lung, namely, the peribronchiolar tissues, the alveolar walls and the pulmonary septa. The alveoli either contained air or had collapsed, and differed from those involved in bronchopneumonia and lobar pneumonia in being relatively free of polymorphonuclear leucocytic exudate. Examination of such areas failed to reveal microorganisms on tissue section. With the advent of secondary bacterial invasion, the gross and microscopic pictures were altered. In some cases it was possible at autopsy to discover areas of acute interstitial pneumonitis adjacent to zones of typical bronchopneumonia, lobar pneumonia or pulmonary abscess. In fact, unless there was such a partition of the lesions, it was impossible to state from the pathological examination that there were really two coexisting lesions in a given case. The presumption is strong that one or more non-bacterial agents cause this type of acute interstitial pneumonitis. The chief evidence from this pathological study is found in the inability to demonstrate consistently any organisms in the lung tissue other than those in bronchiolar lumina. Such bronchiolar organisms are probably derived from the normal respiratory flora, although it cannot be denied that they may play some role in the infection. This apparent freedom from bacteria in tissues where round-cell exudation is seen contrasts with the ease of the demonstration of microbial forms as soon as bronchopneumonia, lobar pneumonia or abscess formation appears. Further evidence of the viral nature of this infection is found in the similarity of the lesion to that seen in some cases of acute influenzal pneumonia, particularly in those in which death occurs in about the first five days of illness. Presumably, the patients succumb to the virus infection before secondary bacterial infection sets in. In measles one may see similar pneumonitis. However, a bacterial infection, such as pertussis, is capable of producing acute interstitial pneumonitis, too, in which case *Hæmophilus pertussis* can be demonstrated in tissue sections.

Burns.

THE results of recent research work in the pathology of burns are summarized by Henry N. Harkins (*Archives of Pathology*, September, 1944). He states that burns do not produce a simple combination of local damage with secondary remote effects. Actually, severe thermal trauma throws the whole regulatory mechanism of the body out of gear. Local œdema leads to oligæmia with hæmoconcentration and other hæmatological and cardiodynamic changes. Increased lymphatic flow may help in the local repair, and it may carry off toxic products, which may produce general damage. Local necrosis and infection delay regeneration and lead to general sepsis. In addition, certain evidence indicates that the entire metabolic and endocrine adjustment of the burned patient may be altered. Certain of these many changes respond readily to therapy; thus the oligæmia is overcome by the administration of plasma. Other alterations in the light of present knowledge are still self-limited. The author remarks that all of these observations indicate the importance of considering the burned patient as a whole rather than as a collection of parts.

Alloxan Diabetes in the Rabbit.

A STUDY by Orville T. Bailey, C. Cabell Bailey and William H. Hagan (*The American Journal of the Medical Sciences*, October, 1944) indicates that the most striking characteristic of the lesion induced by the injection of alloxan is the specificity which it shows for the islets of Langerhans. Furthermore, the β cells are affected most severely and a certain percentage of the α cells remains intact. This specificity not only provides an excellent technique for the production of diabetic animals in the laboratory, but also presents a problem in the correlation of chemical and morphological relationships. The changes outside the pancreas are minor in character from the morphological point of view. This is a further indication of the specificity of alloxan for the islets of Langerhans, and also provides evidence that the animals may be maintained for long periods of time by the administration of insulin without complicating extrapancreatic lesions. From the point of view of the investigator, however, it is unfortunate that the α cells are not completely destroyed. Experimental pituitary diabetes can result in destruction of β cells without destruction of α cells. It would be useful if, in alloxan diabetes, complete destruction of the

islet cells occurred, so that a preparation would be available with the external secreting parenchyma intact, but with all cells of the islets destroyed. Alloxan, however, does not satisfy these requirements. The studies reported by the authors indicate that the lesion of the islets of Langerhans after the injection of alloxan begins its development a very short time after the injection has been given and continues in a steady progression to the fully established lesion. There is no break in the sequence at any point. The lesion is degenerative from the beginning and progresses through a stage of almost complete destruction to one of repair by cells which are unable to secrete insulin. For this reason, the explanation for the hypoglycæmic phase must be sought elsewhere than in a stimulation of the islets of Langerhans. The lack of cellular response to the necrosis in the islets of Langerhans is remarkable. In almost all other forms of necrosis, neutrophile cells may be seen at one stage or another. The response of the islets of Langerhans to alloxan, therefore, offers a biological problem of considerable interest from the standpoint of general pathology.

MORPHOLOGY.

Sensory Cells in the Spinal Cord.

K. A. YOUNGSTROM (*The Journal of Comparative Neurology*, August, 1944) has demonstrated the occurrence in human embryos and young fœtuses of intramedullary sensory neurones apparently of the first order. The number of these cells in any one specimen is variable. Other structures which might be confused with aberrant ganglion cells have been illustrated. It is suggested that many of these intramedullary sensory cells undergo early degeneration. The demonstration of primary sensory cells within the central nervous system is compatible with previous work on the embryology of the neural crest in the head region of human embryos.

Evolution of the Carpal Arch.

H. HUGHES (*Journal of Anatomy*, October, 1944) examined the form of the carpus in a number of vertebrate types which might be expected to give some indication of the sequence of events in the course of primate evolution. He shows that there is little indication of a transverse arching of the carpus in forms below the primates. The arch reaches its highest development in the anthropomorphous apes and man, and in them it is associated with a single-cavity wrist joint at which extensive movements of abduction and adduction can take place. The function of the arch seems to be to stabilize the carpal tunnel in which the flexor tendons lie and thus to facilitate their free movement.

Flexor Pollicis Longus Muscle.

J. DYKES AND B. J. ANSON (*The Anatomical Record*, September, 1944) find that the so-called accessory tendon of the *flexor pollicis longus* is present more frequently than it is absent. An origin from the humerus is almost always present; an additional one from the ulna occurs in about half the cases. These conclusions are based upon a study of 150 extremities, 80 of which were found to possess an accessory tendon of origin, about equally distributed between right and left sides. In 27 cadavers the accessory tendon was bilateral. The regular skeletal origin of the elongate tendon was found to be the medial epicondyle of the humerus; the medial side of the coronoid process of the ulna offered secondary bony origin in 11 of 21 completely dissected extremites, the coronoid alone in one specimen. Invariably the tendon was also attached to the capsule of the elbow joint. Occasionally lesser slips passed to the tendon from neighbouring tendinous structures.

Blood Capillary Circulation.

R. CHAMBERS AND B. W. ZWEIFACH (*The American Journal of Anatomy*, September, 1944) offer evidence for the existence in the capillary bed of a precise mechanism for controlling the rate and amount of blood flow through the bed. Muscular elements are present in the capillary bed proper, but, instead of being indiscriminately distributed, as indicated by Krogh and his supporters, they are restricted to the well-defined, capillary like, central channels and their precapillary offshoots. These channels serve as thoroughfares from arteriole to venule, and in this sense may be regarded as similar to the arterio-venous anastomoses. Functionally, however, they serve a different purpose. They are relatively long vessels and bear a close relationship to the true capillaries. Under normal conditions the central channels always remain open so that any spontaneous restriction of flow is caused by contraction of the precapillary offshoots only. The recurrent vasomotion of the metarterioles is the factor which controls the rate of flow through the central channels, while the alternate opening and closing of the sphincters of their precapillary offshoots induce an intermittent flow through the true capillaries without interfering with the flow in the central channels. A significant feature of the muscular components of the capillary bed, particularly the metarterioles and precapillaries, is their reactivity to epinephrine and to nerve stimuli and their susceptibility to local changes in the condition of the tissue in which they lie. When the tissue is in a state of comparative rest the periodic phases of vasomotion are augmented. This results in a restriction of the circulation to the central channels except for a sporadic blood flow in the true capillaries. Resting tissue is thus relatively ischæmic. When the tissue is activated, as by mechanical irritation, so that conditions arising from the tissue predominate, the vasomotion ceases and the metarterioles and precapillary sphincters become dilated. Thereupon, the capillaries become flooded with blood and hyperæmia results. The metarterioles and precapillaries form an integral part of the capillary bed proper and their reactive muscular elements are so disposed as to be fully exposed to chemical changes in the environment. It would appear that, at least in the visceral tissues, the functional autonomy of the peripheral vascular system depends largely on two features. One is the peculiar architecture of the capillary bed with the highly specific arrangement of its muscular vessels. The other is the intermittent vasomotion of its metarterioles and precapillaries, the responsiveness of which is readily affected by local tissue conditions.

Fascia Underneath the Pectoralis Major.

F. C. LEE (*The Anatomical Record*, September, 1944) calls attention to the existence of a fascia attached to the under surface of the *pectoralis major* muscle and apparently not previously described. This fascia is placed nearer to the *pectoralis minor* muscle, but anatomically it is more closely associated with the *pectoralis major*, from which it is separated by a layer of fat which transmits the nerves and vessels supplying most of the *pectoralis major*. This fascia contains a large amount of elastic tissue and can be stripped easily from the *pectoralis minor*. It is not identical with the deep pectoral fascia, and the name of *fascia interpectoralis musculorum* is suggested for it. It was found also in the gorilla, chimpanzee and *Macacus rhesus*.

Cell Replacement in Adrenal Cortex.

P. GRUENWALD AND W. M. KONIKOV (*The Anatomical Record*, May, 1944) state that, as the adrenal cortex is very sensitive to normal and abnormal stimulation as well as to damaging agents, many of its reactions require rapid new formation of cells either to replace damaged and worn parenchyma or to produce hypertrophy. The authors supply evidence that replacement of functioning cortical cells takes place by three mechanisms: (*a*) mitotic division of cells at the junction of the *zona glomerulosa* and *fasciculata*, (*b*) mobilization of cells from a reserve store represented by the *zona glomerulosa*, and (*c*) replacement of depleted stores by differentiation of new cortical tissue from the capsule, that is, by apposition from the capsule. It appears that the influence of demand for cortical cells on differentiation in the capsule is probably an indirect one, through depletion of the *zona glomerulosa*.

Grafts of Frozen and Thawed Skin.

R. BRIGGS AND L. JUND (*The Anatomical Record*, May, 1944) report that ventral skin from mice three to five weeks old remains viable after slow freezing to −78·5° C. and rapid thawing to 25° or 30° C. When the thawed skin is grafted autoplastically 52% of the grafts take wholly or in part, and persist as functional skin. Ventral skin from young mice, stored unfrozen at 0° C. for five to twenty days, has the appearance of normal skin, but in the majority of cases fails to take when grafted autoplastically. Two of five grafts stored for five days, and two of four grafts stored for ten days, were grafted successfully. A total of eleven grafts stored for fifteen and twenty days all failed. A skin grafting procedure is described which produces 100% takes of ventral skin grafted autoplastically to the dorsum in young mice (three to five weeks old). Autoplastic grafts of dorsal skin to the venter in young mice take wholly or in part in 79% of the cases. Grafts of both types appear to take less rapidly in mature mice eight and a half to ten weeks old.

Medical Societies.

MELBOURNE PÆDIATRIC SOCIETY.

A MEETING of the Melbourne Pædiatric Society was held on October 11, 1944, at the Children's Hospital, Carlton, Melbourne, DR. ALAN MCCUTCHEON, the President, in the chair. Parts of this report were published in the issues of May 19, 1945, and June 2, 1945.

Renal Calculus.

DR. H. DOUGLAS STEPHENS showed a male child, aged eleven years and ten months, who had been admitted to hospital on August 24, 1944, with the provisional diagnosis of left renal calculus. The child had suffered from poliomyelitis at the age of five years. He had also suffered previously from pneumonia and measles. There was no family history of tuberculosis. Seven years earlier he had begun to suffer from attacks of pain in the left lumbar region, sometimes associated with vomiting. These attacks had become more frequent, and over the few weeks before his admission to hospital the pain became worse, causing sleeplessness. Four years prior to his admission to hospital he had passed blood-stained urine. Two years later he had another attack of hæmaturia. Three weeks before his admission to hospital he again passed blood, and since then the urine had gradually cleared. With each attack of hæmaturia he vomited. His mother said that he had always been pale. His appetite was poor; his bowels were open regularly.

On examination, he was seen to be a pale thin boy. The temperature was 98·4° F. The pulse rate was 68 per minute, and the respirations numbered 20 per minute. The heart, lungs and abdomen appeared to be normal. A post-poliomyelitis *talipes equino-varus* of the left foot and a slighter degree of talipes of the right foot were present. The specific gravity of the urine was 1,018; it was neutral in reaction and contained albumin and blood in large quantities. No sugar, diacetic acid or acetone was demonstrable; microscopic examination revealed a fair number of pus cells and red blood cells. On July 2, 1944, an excretion pyelogram had been made in a private hospital. The pelvis of the right kidney was normal in size and position, and excretion was somewhat less than on the left side. The left kidney apparently was affected by a developmental abnormality, an error of rotation and a slight degree of hydronephrosis. The ureters were normal. On April 14, 1944, a retrograde pyelogram had been made and a specimen of urine taken from each ureter. A straight X-ray film revealed a calculus in the lower part of the left kidney, and there was a little hydronephrosis of that kidney. Excretion was satisfactory from each kidney. No radiographic abnormality was demonstrable in the right renal tract. The urine showed a few epithelial cells and red cells; more of the latter were obtained from the right ureter. On August 21 extraperitoneal nephrotomy with removal of the calculus from the lower pole of the left kidney was carried out. A blood transfusion was given nine days after the operation, but otherwise the convalescence was uneventful.

Dr. Stephens said that the patient was shown for two reasons. Firstly, because calculus was less frequent lately than it had previously been. This was partly attributed to the fact that patients suffering from osteomyelitis were not confined to bed for such long periods as before, and the treatment of other ailments had been speeded up. In this case the onset of the condition was with recumbency necessitated by poliomyelitis. The second object in showing the patient was to stress the importance of a straight X-ray film as a preliminary to excretion pyelography. Unless this sequence was carried out, the presence and position of a renal calculus might easily be obscured.

DR. ROBERT SOUTHBY asked Dr. Stephens whether he had met with any cases of renal calculus associated with vomiting, but with negative urinary findings. He remembered a delicate child of a tuberculous mother, who was suspected of suffering from abdominal tuberculosis. Attacks of pain followed the eating of ice cream or pastry. The urine was examined on several occasions and ketone bodies were found. One night the child was taken violently ill, and frequency of micturition and dysuria occurred. Finally the child passed a phosphate calculus, which had apparently blocked the ureter completely and prevented the classical sign of hæmaturia from making its appearance.

DR. BRUCE HALLOWS said that he was interested in the relationship of calculus to osteomyelitis. He remembered a child at the Frankston branch two years earlier suffering from severe osteomyelitis of the upper end of the femur. After a long period of recumbency he had developed a renal calculus; this demonstrated the aptness of Dr. Stephens's remarks.

DR. KEITH HALLAM seconded the warning issued by Dr. Stephens regarding the danger of making an excretion pyelogram without taking preliminary straight X-ray films of the renal tract. Frequently he had been confronted with distorted calyces in the excretion pyelogram, which subsequently proved to be normal. However, excretion pyelography had its value. This was probably intermediate between straight X-ray examination and retrograde pyelography.

Dr. Stephens, in reply, said that he could not recall a case similar to that quoted by Dr. Southby. He remembered a child, aged seventeen months, suffering from colic and hæmaturia. The stone was one and a half inches long and had to be removed; it was of the oxalate variety. There was no question that any long-continued illness was a predisposing factor to calculus formation. Dr. Stephens once more laid emphasis on the value of a straight X-ray film preceding the taking of an excretion pyelogram. He thanked the speakers for their remarks.

Pathological Specimens.

DR. REGINALD WEBSTER exhibited a number of pathological specimens, illustrative of bronchiectasis and of tumours of the intestine in childhood.

Bronchiectasis.

Dr. Webster said that he was led to introduce the subject of bronchiectasis by the receipt of a lobe of a lung so affected; it had been removed surgically by Dr. J. G. Whitaker from a child, aged eight years, since the previous meeting of the society. Dr. Webster said that bronchiectasis had been prominent in the programmes of recent months; but no one had clarified what had always been for him the confusing subject of ætiology, with which was involved what might be termed the dynamics of the condition. It had been said that the dynamics of bronchiectasis and aneurysm of the aorta were comparable; but it had always seemed to him that the processes leading to bronchial dilatation were more complex than those operating in the production of aneurysmal expansion.

Dr. Webster went on to say that there appeared to be two main contesting theories: (i) that infection of the bronchial wall, with destruction of its muscle and elastic tissue, was the primary cause, collapse or consolidation of the lung being a secondary and perhaps adjuvant effect; (ii) that collapse of the whole or part of a lobe created the physical conditions promoting bronchial dilatation, which was made permanent and symptom-producing by subsequent infection. Dr. Webster recalled having read some time ago an article by McNeil *et alii* based on an exhaustive study of the lungs of seven children affected with bronchiectasis, in which the view was cogently presented that destruction of the bronchial wall and often of the contiguous pulmonary alveoli was the essential factor. It was argued that often not a trace of muscle, elastic tissue or even cartilage was to be detected in the walls of the cylindrical and saccular spaces. Such walls were fibrous in nature, lined by a restored and modified epithelium, and the result of the organization of the granulation tissue which was the first reaction to the damage inflicted on the bronchus. On this view the cavities commonly termed bronchiectatic were not dilated bronchi at all, but vomical comparable to those of other suppurating and tuberculous cavities. How correct such doctrine might be he would not presume to assess, but as he had said, he found the subject a little confusing. In the bronchiectasis supervening on atelectasis, pulmonary collapse seemed to initiate the cycle; in that related to measles the *fons et origo* of the child's pulmonary troubles seemed to be weakening and destruction of the bronchial wall. Apparently the sinister train of events might be set in motion at more than one point.

Intestinal Adenomata.

Dr. Webster then demonstrated a specimen recently acquired by Dr. J. G. Whitaker from a girl, aged seven years, upon whom he had operated for the relief of intestinal obstruction occasioned by an entero-enteric intussusception. Remarkable features about the intussusception were its situation in the proximal portion of the jejunum, not more than two feet from the duodeno-jejunal flexure, the ease with which reduction was effected, and the presence within the lumen of the gut of several palpable tumours, the most distal of which formed the apex of the intussusception. The specimen as shown consisted of the resected segment of the jejunum, approximately fifteen centimetres in length, with

an exposed cluster of tumours projecting into the lumen. There were six such tumours, of varying size, the largest being about the size of a small walnut; some were dome-shaped and sessile, others more frankly polypoid. Microscopically the structure was clearly adenomatous and villous or polypoid in general design. The child made an excellent recovery.

Dr. Webster also showed another intestinal tumour, and a submucous cyst of the caecum, both of which had been provocative of intussusception. The first of these was a small myoma of the intestine, which had been implicated in a small bowel intussusception, occurring and terminating happily in the private practice of Dr. Whitaker approximately ten years earlier. The submucous cyst of the caecum, situated in immediate juxtaposition to the ileo-caecal valve, proved an insuperable obstacle to the reduction of an ileo-colic intussusception in an infant upon whom Dr. Howard Williams had operated at the hospital in 1941. Resection was successfully undertaken; but unfortunately the baby died a week later from fulminant pneumococcal meningitis. At the autopsy, conditions in the abdomen were seen to be all that could be desired. Within recent years at the hospital there had been two instances of intussusception in infancy initiated by invagination of a Meckel's diverticulum.

Reverting to the specimen he had presented, Dr. Webster said that although multiple papillomata or adenomatous polypi might arise in any part of the intestinal canal, they were located more frequently in the large bowel than the small bowel, and particularly in the rectum. In the often familial condition of multiple polyposis of the intestine the entire large bowel might be studded with polypi in fantastic and incredible numbers. In the adult, papillomata and adenomata of the bowel were regarded with suspicion as precursors of malignant disease, and two specimens of carcinoma of the colon in childhood which he had placed on view suggested that the possibility of a similar sequence in children was not to be ignored.

Dr. Webster continued with a reference to "carcinoid" tumours of the intestine, known also as chromaffinomata and argentaffinomata. They were derived from certain chromaffine cells of the endocrine system, which were distributed among the columnar epithelial cells of the crypts of Lieberkühn, and although they were most likely to arise in the appendix, they occasionally appeared in the small intestine. Carcinoids of the vermiform appendix had a local and non-lethal malignancy only; but such tumours had proved more dangerous in the small intestine, becoming obstructive and metastasizing in the mesenteric lymph glands in a proportion of instances. The name "argentaffinoma" had been applied to these growths to connote the fact that the tumour cells stained intensely by silver impregnation methods.

In conclusion, Dr. Webster showed two specimens of sarcoma of the caecum, which he had taken from the hospital pathological museum.

A MEETING of the Melbourne Pædiatric Society was held on November 8, 1944, at the Children's Hospital, Carlton, Melbourne, DR. ALAN MCCUTCHEON, the President, in the chair.

Empyema.

DR. JOHN GOOCH showed a male baby, aged nine months, with a history of a cold of four days' duration. For two days he had been feverish, vomiting and breathing noisily and with difficulty. On examination of the child, the temperature was 101·8° F. and the pulse rate 160 per minute, and the respirations numbered 38 per minute. He was flushed, listless, grunting and slightly cyanotic. The throat was reddened, the left ear drum was slightly injected, there was poor air entry at the bases of both lungs, and coarse râles were audible all over both lungs. Though there were no meningeal signs, lumbar puncture was performed. The cerebro-spinal fluid was clear and contained three cells per cubic millimetre. The child was given sulphadiazine tablets every four hours and thirty grains of potassium citrate at intervals of four hours. Three days later the temperature was higher, and he was very ill and distressed. The percussion note was dull and breath sounds were faint at the base of the right lung posteriorly. A needle was inserted into the chest in the scapular line in the eighth intercostal space, and six cubic centimetres of pus were obtained. Culture of this pus yielded a growth of *Staphylococcus aureus*, which was sensitive to penicillin in a strength of one-tenth of a unit per millimetre. Next day the sulphadiazine treatment was stopped. Daily aspirations and injections of 2,500 units of penicillin into the chest, and intramuscular injections of 5,000 units of penicillin every three hours, were proceeded with. After thirteen days aspiration was performed every second day. No pus was obtained after the twenty-first day, but intramuscular injections of penicillin were continued until the twenty-seventh day. The amount of pus aspirated totalled 618 cubic centimetres. The amount of penicillin given was 220 intramuscular injections totalling 1,100,000 units and 17 intrathoracic injections totalling 425,000 units. The grand total of penicillin, therefore, was 1,525,000 units. The child's condition improved slowly from the onset of penicillin treatment, and he was well after two weeks. On his discharge from hospital ten days after treatment was stopped, or six weeks after his admission to hospital, the percussion note was impaired, but air entry was good at the base of the right lung and the X-ray examination revealed clearing congestion of the right lung. The hæmoglobin value was 98% and the leucocytes numbered 13,000 per cubic millimetre of blood.

Dr. Gooch said that this was the second case of staphylococcal empyema in which treatment with penicillin had been successful. During the last nine years a total number of 214 patients suffering from empyema had been admitted to the hospital; 71 of these had died. In forty-five cases the diagnosis was made at autopsy. In only two of these cases was empyema suspected. The patients were usually young babies with short histories of illness. The *Staphylococcus aureus* was the causal organism in thirty cases; ten of these cases were fatal. Twelve patients were aged under one year, and six of these died. Dr. Gooch said that of the patients suffering from empyema who recovered, thirteen were treated by aspiration, fourteen by intercostal drainage and 113 by rib resection and drainage.

Sturge's Disease.

DR. ROBERT SOUTHBY showed a male child, aged fifteen months, who had been admitted to the hospital at the age of three months because of a "turn", in which the principal feature was difficult breathing. The child had a large nævus involving both sides of the face. X-ray examination of the chest revealed an upper thoracic shadow suggesting either thymic hypertrophy or enlarged glands. Deep X-ray therapy was applied, with considerable improvement, and the findings in a recent X-ray film were reported to be within normal limits. However, the "turns" recurred; the baby was observed to nod, go blue and lose consciousness, and recover quickly. X-ray examination of the skull revealed shadows consistent with intracranial calcification. On these grounds a diagnosis of Sturge's disease was made—a syndrome characterized, *inter alia*, by nævus formation, epileptiform seizures and intracranial calcification. In most cases the nævus was unilateral; in this case the condition was bilateral. The child had remained reasonably well while taking bromide and phenobarbitone. Dr. Southby said that interest was aroused in this syndrome, since two similar cases had been discussed at previous meetings of the society, the first by himself and the second by Dr. Wait. Under-development of the left side of the cerebral cortex had been demonstrated in the first case; the second child, who was older, had intracranial calcification as well as cerebral agenesia.

(To be continued.)

Post-Graduate Work.

REFRESHER COURSE IN MELBOURNE.

THE Melbourne Permanent Post-Graduate Committee announces that the following demonstrations will be given as a refresher course from June 25 to July 7, 1945.

First Week.

Monday (at Royal Melbourne Hospital).—Morning: "Swellings in the Breast" and "Painful Shoulder and Wrist", by Dr. W. D. Upjohn. Afternoon: "Medical Cases", by Dr. S. O. Cowen.

Tuesday (at Alfred Hospital).—Morning: "Foot Pain and Ulceration of the Leg", by Dr. F. Maclure. Afternoon: "Medical Cases", by Dr. W. S. Newton.

Wednesday (at Saint Vincent's Hospital).—Morning: "Diseases of Joints", by Dr. G. Shaw. Afternoon: "Cardiac Cases", by Dr. J. Horan.

Thursday (at Royal Melbourne Hospital).—Morning: "Chronic Diarrhœa", by Dr. L. Hurley. Afternoon: "Skin Diseases in General Practice", by Dr. J. I. Connor.

Friday.—Morning (at Women's Hospital): "Puerperal Sepsis and General Ward Demonstration", by Dr. A. Hill. Afternoon (at Children's Hospital): "The Non-Thriving Infant", by Dr. J. W. Grieve.

Saturday (at Medical Society Hall, Albert Street, East Melbourne).—Morning: "Tropical Disease in Returned Soldiers", by Colonel H. H. Turnbull.

Second Week.

Monday (at Alfred Hospital).—Morning: "Post-Operative Complications and Treatment", by Dr. L. Ball. Afternoon: "Blood Diseases", by Dr. J. McLean.

Tuesday (at Saint Vincent's Hospital).—Morning: "Application of Plaster Casts", by Dr. T. King. Afternoon: "Control by Artificial Pneumothorax and other Cases in the Wards", by Dr. J. Newing.

Wednesday.—Morning (at Royal Melbourne Hospital): "Common Neurological Conditions", by Dr. E. G. Robertson. Afternoon (at Royal Park Hospital): "Mental Diseases in Old Age and Electrotherapy in Melancholia", by Dr. A. K. Adey.

Thursday.—Morning (at Royal Melbourne Hospital): "Radiological Demonstration with Emphasis on Value and Limitations of Certain Examinations", by Dr. Barbara Wood. Afternoon (at Eye and Ear Hospital): "External Diseases of Eyes and Minor Operations", by Dr. M. Gardner; "Ear, Nose and Throat Conditions of Interest to the General Practitioner", by Dr. C. Cantor.

Friday.—Morning (at Royal Melbourne Hospital): "Ano-Rectal Surgery", by Dr. J. Turner. Afternoon (at Fairfield Hospital): "Infectious Diseases", by Dr. F. V. Scholes.

Saturday (at Medical Society Hall, Albert Street, East Melbourne).—Morning: "Recent Advances in Therapeutics", by Dr. B. Lawton.

In addition to the subjects arranged, opportunity will be given for discussion of problems submitted by those taking part in the course. Luncheon will be provided each day at the hospital concerned.

During the same two weeks, Professor F. M. Burnet will give the following series of lectures on "The Background of Infectious Diseases in Man". These will be given at 8.15 p.m. in the Lecture Theatre, Royal Melbourne Hospital.

June 25.—"General Principles: Epidemiology of Human Infections."
June 28.—"Diphtheria, Measles and Rubella."
June 29.—"Poliomyelitis."
July 2.—"Rheumatic Fever."
July 5.—"Respiratory Infections."
July 6.—"Tuberculosis."

Fees for the above courses are: Refresher, £5, with £3 3s. per week for residence. Professor Burnet's lectures, £3 3s. Medical officers who have been on full-time active service during the present war are exempt from these fees. Entries should be in the hands of the Secretary, Royal Australasian College of Surgeons Building, Spring Street, Melbourne, two weeks before the commencement of the course.

Medical Prizes.

THE JACKSONIAN PRIZE.

THE acting secretary of the Royal Australasian College of Surgeons announces that a cable has been received from the Royal College of Surgeons of England, stating that the subject for essays for the Jacksonian Prize for 1946 is "Traumatic Aneurysm".

University Intelligence.

THE UNIVERSITY OF MELBOURNE.

THE following information is taken from the issue for May 24, 1945, of the *University Gazette*, which is published by the Registrar for the Council of the University of Melbourne.

Enrolments for Lectures.

Among the comparative statistics of enrolments for lectures up to April 13, 1945, are tables covering all the faculties for the years 1943, 1944 and 1945. The table for the faculty of medicine is as follows:

Group.	May, 1943.	June, 1944.	April, 1945.
First year	114	143	165
Second year	126	118	138
Third year	117	113	98
Fourth year	93	107	111
Fifth year	85	86	94
Medicine (single subjects)	7	—	1
Post-Graduate Medical Diplomas	—	—	36
Total	542	567	643

The total number of students for all the faculties for the three years were respectively 2,932, 3,326 and 3,814.

Benefactions.

Among the donors and bequests recently received by the university is a gift of £200 from the W. C. F. Thomas Charitable Trust for medical research.

Books for the Rowden White Library have been given by the Chancellor, Sir James Barrett, and Dr. A. E. Rowden White.

The late Sir James Barrett bequeathed to the university the sum of £750 towards the foundation of a school of nursing or to be applied otherwise as the Council shall decide, together with certain medical instruments and appliances, medical books and treatises, and several sets of ophthalmological journals.

Proposed Future of the Medical Course.

The Committee of Vice-Chancellors of the Australian Universities, at its meeting in February, approved for submission to the governing bodies of the universities certain resolutions of a conference of medical deans held at Sydney in October, 1944. The University Council, at its meeting on April 9, referred to the faculty of medicine for its opinion the resolutions to the following effect:

1. That provision be made for reversion by gradual stages to the normal length of the medical course.
2. That the universities be asked to investigate the possibility of establishing a course of five academic years followed by one year of hospital residence.
3. That the principles of admission to the first year of the course be correlated with the facilities for training in the higher years.
4. That there should be a standardized first year in the various universities concerned with special courses for medical students in physics, chemistry and biology, and a preliminary course in anatomy.
5. That provision for medical registration should be uniform throughout the Commonwealth, and that a conference of representatives of registration authorities and of medical schools should be called with this object in view.
6. That absolute preference in admission should be given to qualified ex-servicemen.
7. That a regular health survey, including X-ray examinations and health services, be established for all students.
8. That certain adjustments be made in the method of selecting Nuffield Research Fellows.

Staff Changes.

Dr. K. F. Russell, who has been on leave since 1940 for service with the army and has served in the Middle East (Libya and Tobruk), Australia and New Guinea for over four years, has resumed duties as senior lecturer in anatomy. Dr. Russell was recently admitted as Fellow of the Royal Australasian College of Surgeons.

Dr. J. A. Larwill has been appointed senior lecturer in histology and embryology.

Dr. E. S. R. Hughes has been appointed lecturer in anatomy.

Dr. M. C. Davis has been appointed Stewart scholar in medicine for 1945-1946.

Dr. D. F. Thomson, Research Fellow in Anthropology in this university, who was formerly acting wing-commander in the Royal Australian Air Force, has been awarded the "O.B.E." for special services in New Guinea. Dr. Thomson led an expedition on foot in a 200 miles journey through completely unexplored swamps. During the expedition he assisted, though seriously wounded, in repelling an attack by about 200 natives. "His courage, determination and ability",

says the citation, "together with his exceptional powers of leadership, were in the highest traditions of the service."

Miss E. F. M. Stephenson, senior demonstrator in chemistry, has been awarded a Fellowship by the International Federation of University Women, London. She proposes to leave shortly for the University of Glasgow under the terms of the Fellowship.

Miss N. R. McArthur, B.A., has been appointed as Haley Research Officer in the Department of Experimental Medicine.

Obituary.

EDWARD SUTHERLAND STOKES.

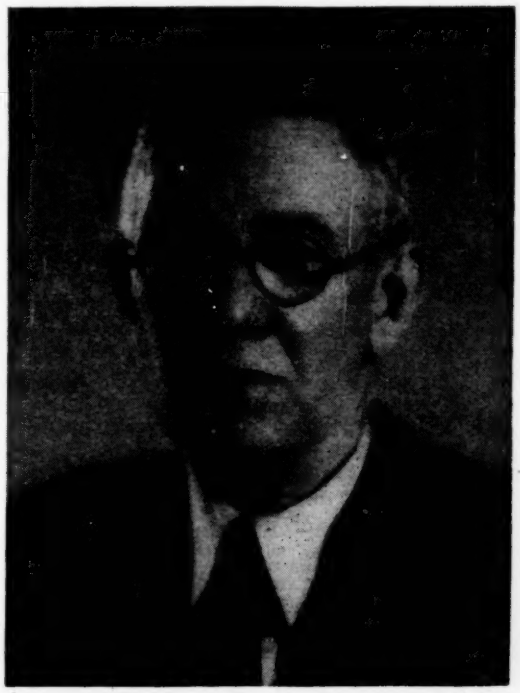
EDWARD SUTHERLAND STOKES, whose death was announced in a recent issue, was born at Newcastle, New South Wales, on March 6, 1869, and died at Lindfield on April 12, 1945. He was the eldest of seven sons of Henry Edward Stokes, whose father, Francis Michael Stokes, was one of the original proprietors of *The Sydney Morning Herald*. He was educated at the Newcastle Grammar School, one of his fellow pupils being the late Dr. Reginald Jeffery Millard. Having decided to study medicine, he entered Saint Andrew's College (within the University of Sydney), and he graduated in 1891 with second class honours, being second in the year to the late Dr. George Henry Abbott. He served for a year as resident medical officer at the Prince Alfred Hospital, the medical superintendent being Dr. Cecil Purser. He was also a member of the resident staff of the Sydney Hospital for a short time. He practised at Port Macquarie, Murrumburrah and Crookwell, and then decided to enter the public service. His first appointment was as medical officer to Trial Bay Gaol. He then went to Great Britain, where he obtained the Diploma of Public Health, passing with honours the examination held by the Royal College of Physicians and Surgeons of Ireland. After his return to Sydney in 1901 he was appointed to the position of assistant medical officer of health of the Metropolitan Combined Districts and worked with the late Dr. Ashburton Thompson and the late Dr. Frank Tidswell in the investigation and control of the outbreak of plague. In 1904 he became medical officer to the Metropolitan Water Supply and Sewerage Board (later known as the Metropolitan Water, Sewerage and Drainage Board) and occupied this position till 1935. After retirement from the Board he practised privately as a water technicologist until 1942, when, owing to the death of his successor, the late Dr. George Lord Saunders, and the exigencies of the war position, he returned to his old post from which he finally retired in December, 1943.

He took a keen interest in military medical matters, having been a member of the Australian Army Medical Corps since 1906. At the outbreak of the war of 1914-1918 he held the rank of major and went abroad in 1914. He was one of the two medical officers attached to the troopship *Clan McCorquodale*, his colleague being Dr. Piero Fiaschi, whom he assisted in an operation on a sergeant of the First Field Company of Engineers while the ship was crossing the Australian Bight. This was one of the first major operations (probably the first) performed on a member of the first Australian Imperial Force. In Egypt he rejoined his unit, the First Field Ambulance, under the command of the late Lieutenant-Colonel B. J. Newmarch, the other major being his old school mate, R. J. Millard. The captains were the late C. E. Wassell, the late W. E. Kay and the late J. B. St. Vincent Welch, and H. R. G. Poate, Archie Aspinall and L. W. Dunlop. He took part in the landing on Gallipoli, his particular task being to supervise the purity of the water supplied to the troops. After return from Gallipoli in 1915 he was promoted to the rank of colonel and was appointed to the position of Principal Medical Officer of the Second Military District (New South Wales). In 1917 he returned to his position at the Water and Sewerage Board.

Edward Sutherland Stokes was a recognized authority on the chemistry and bacteriology of water and on the treatment of sewage. Before the war of 1914-1918 he read papers before medical congresses on the following subjects: "Sewage Treatment" (*Australasian Medical Congress, Transactions of the Seventh Session*, Adelaide, 1905, page 395); "Bacteriological Examination of Water" (*Australasian Medical Congress, Transactions of the Eighth Session*, Melbourne, 1908, page 203); "The Scope of Water Analysis in Military Service" (*Australasian Medical Congress, Transactions of the Ninth Session*, Sydney, 1911, page 1093). He also read a paper entitled "A Rapid Method of Determining the Probability of Decomposition Occurring in a Sewage Effluent" before the Australasian Association for the Advancement of Science in 1911 (*Report*, page 679).

He was a foundation member of the Sydney Technical College Chemical Society, before which he presented a number of important papers. He also occupied various offices in the society, including that of president. He had been a member of the Royal Society of New South Wales since 1909. He took a keen interest in the Public Medical Officers' Association and occupied the position of chairman for a year. He reviewed books for this journal, and the views that he expressed were both clear and discerning. While at the Metropolitan Water, Sewage and Drainage Board he wrote an essay on Dupuytren's contracture, to which reference is made frequently in Workers' Compensation cases. In conjunction with Dr. A. J. Hood Stobo he designed an improved apparatus for the production of artificial pneumothorax which has been used extensively.

His wife predeceased him in 1944 and he is survived by a son, Dr. E. H. Stokes, and a daughter.



DR. ARCHIE ASPINALL writes: Just before the outbreak of war in 1914, the late Dr. B. J. Newmarch, surgeon at Sydney Hospital, induced Kay, Wassell, Dunlop and myself, then resident medical officers, to join the Australian Army Medical Corps. To the amusement of many of our medical friends we spent Saturday afternoon at Victoria Barracks or carrying out field exercises in the bush near by. It was there that we met Dr. E. S. Stokes, who held the rank of major and was very keen on all Australian Army Medical Corps work. We were together in the Eighth Field Ambulance which volunteered for active service, and left as the First Field Ambulance, Lieutenant-Colonel Newmarch as officer in command, with Captains St. Vincent Welch and Poate forming A Section, Major Millard, and Captains Dunlop and Wassell, B Section, and Major Stokes, and Captains Aspinall and Kay, C Section. During the training in Egypt, "Stokey", as he was known to us, found there was little scope for his scientific training, but worked hard, and his cryptic remarks were a great joy to us. He was early ashore after the landing at Anzac and was responsible for the medical supervision of the water supply, but there was little he could do with the equipment available, and on returning to Australia he was appointed Principal Medical Officer, where he had a very difficult job. When I visited him about two months before his death he showed me round the wonderfully equipped private laboratory he had

built at his home at Lindfield, and displayed all the enthusiasm for research work that had characterized his medical life. Stokes was of a retiring nature and had a brusque manner, but was most kindly and very much liked by those who were his friends.

DR. HAROLD RITCHIE writes: The late Edward Sutherland Stokes was an extremely able man. After a few years in private practice he found his true niche in controlling the laboratory work of the Water and Sewerage Board and in providing technical advice to the Board. The citizens of Sydney have much to thank him for. It is largely due to his intimate knowledge of his subject that Sydney is provided with so excellent a water and sewerage system. He had a fine laboratory and kept himself abreast of all the advances of science. He had a good mind and great powers of application. It might truthfully be said that he was never idle. Although his labours were intimately known to few, he performed a successful task for the city of Sydney, and he deserves to be recorded as one of the best examples of those who give their services to the public.

A.J.H.S. writes: With the passing of Dr. E. S. Stokes the medical profession has suffered the loss of one who, though he took no prominent part in medical affairs, was well known to many and earned the gratitude of many younger men for much encouragement and practical help in the early stages of their careers.

With wide interests and the possessor of unusual general knowledge, Stokes was an authority on such diverse subjects as the composition of cement and Dupuytren's contracture. It was on account of his work in the bacteriology and chemistry of water, however, that he was best known.

Of small stature, his natural reserve at first gave the impression of gruffness, but this was soon dispelled on acquaintance, and a day spent with him inspecting the storage dams for the water supply of Sydney was a delightful experience on account of his cheerful company and good stories, his knowledge of the bush and the trouble he took to explain everything of interest.

He was happiest in his laboratory and workshop, where he worked up till the day before he died, and it is pleasing to know that after a full life his end was sudden, as he would have wished.

Nominations and Elections.

THE undermentioned have applied for election as members of the New South Wales Branch of the British Medical Association:

Parker, Anthony Owen, M.B., B.S., 1942 (Univ. Sydney), 738, New South Head Road, Rose Bay, New South Wales.

Green, Robert Musgrave, Provisional Registration, 1945 (Univ. Sydney), Sydney Hospital, Sydney, New South Wales.

Howe, René Edgar, Provisional Registration, 1945 (Univ. Sydney), Royal North Shore Hospital, St. Leonards, New South Wales.

Child, Margaret Eileen, M.B., Ch.B., 1930 (Univ. Glasgow), Nincoola, Guyra, New South Wales.

The undermentioned have applied for election as members of the Tasmanian Branch of the British Medical Association:

Kuhlmann, Herman Frederick, M.B., B.S., 1943 (Univ. Adelaide), Campbell Town, Tasmania.

Starr, John, M.B., 1944 (Univ. Sydney), Royal Hobart Hospital, Hobart, Tasmania.

Little, John Hamilton, M.B., B.S., 1945 (Univ. Melbourne), Royal Hobart Hospital, Hobart, Tasmania.

Naval, Military and Air Force.

DECORATIONS.

THE undermentioned medical officers of the Royal Australian Navy have been mentioned in dispatches: Surgeon Lieutenant Commander James Estcourt Hughes, M.S., F.R.A.C.S., of Adelaide; Surgeon Lieutenant Graeme Lindsay Grove, M.B., B.S., of Melbourne; Surgeon Lieutenant John Henry Begg, M.B., B.S., of Sydney; Surgeon Lieutenant Michael Dean Dawson, M.B., B.S., of Adelaide.

CASUALTIES.

ACCORDING to the casualty list received on June 4, 1945, Captain J. W. McNamara, A.A.M.C., Mosman, New South Wales, previously reported prisoner of war, is now reported "recovered".

Medical Appointments.

Dr. Frank McCallum has been appointed Acting Director-General of Health (Commonwealth Department of Health) and Acting Director of Quarantine during the absence on recreation leave of Dr. J. H. L. Cumpston from June 1 to 18, 1945, inclusive.

Diary for the Month.

JUNE 12.—New South Wales Branch, B.M.A.: Executive and Finance Committee.
JUNE 12.—Tasmanian Branch, B.M.A.: Ordinary Meeting.
JUNE 18.—Victorian Branch, B.M.A.: Hospital Subcommittee.
JUNE 18.—Victorian Branch, B.M.A.: Finance, House and Library Subcommittee.
JUNE 19.—Victorian Branch, B.M.A.: Organization Subcommittee.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Honorary Secretary, 135, Macquarie Street, Sydney): Australian Natives' Association; Ashfield and District United Friendly Societies' Dispensary; Balmain United Friendly Societies' Dispensary; Leichhardt and Petersham United Friendly Societies' Dispensary; Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney; North Sydney Friendly Societies' Dispensary Limited; People's Prudential Assurance Company Limited; Phœnix Mutual Provident Society.

Victorian Branch (Honorary Secretary, Medical Society Hall, East Melbourne): Associated Medical Services Limited; all Institutes or Medical Dispensaries; Australian Prudential Association, Proprietary, Limited; Federated Mutual Medical Benefit Society; Mutual National Provident Club; National Provident Association; Hospital or other appointments outside Victoria.

Queensland Branch (Honorary Secretary, B.M.A. House, 225, Wickham Terrace, Brisbane, B.17): Brisbane Associated Friendly Societies' Medical Institute; Bundaberg Medical Institute. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.

South Australian Branch (Honorary Secretary, 178, North Terrace, Adelaide): All Lodge appointments in South Australia; all Contract Practice appointments in South Australia.

Western Australian Branch (Honorary Secretary, 205, Saint George's Terrace, Perth): Wiluna Hospital; all Contract Practice appointments in Western Australia. All Public Health Department appointments.

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